Pit and Quarry
With which is consolidated
CEMENT-MILL & QUARRY
September 21, 1932

SEP 26 1932

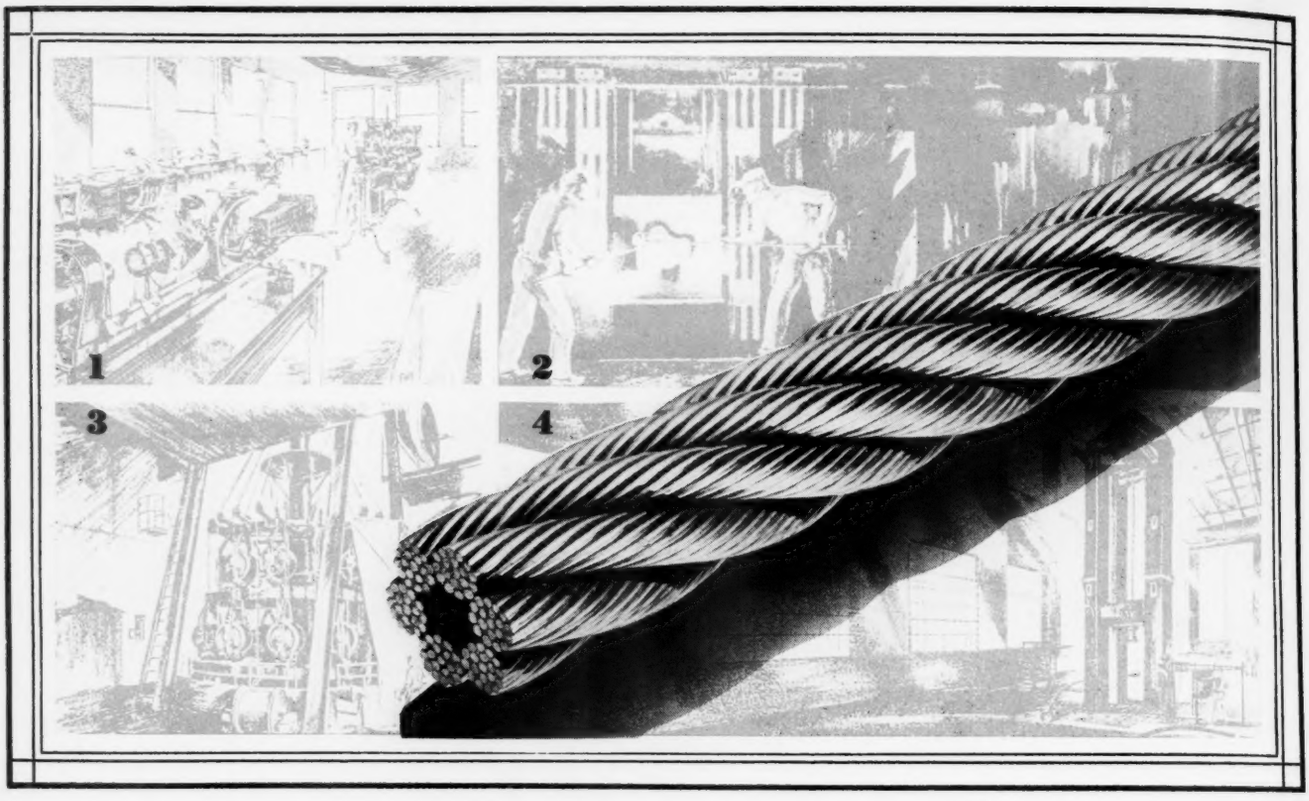
Highway Robbery

It is a long time since "highway robbery" signified more than a rhetorical exaggeration applied to minor offenses, but if the wholesale raiding of the states' gasoline-tax funds for non-highway purposes and the attempt to place government burdens on highway users continues, we may be forced to give more than a rhetorical meaning to a term that once described a crime second only to murder. We may not apply to highway robbery in its modern form the same penalty of capital punishment meted out to those who were guilty of the older highway robbery, but there is no reason why political death may not be the none-too-harsh punishment for those who misapply public money. Highway robbery was and still is the crime of robbing those who use the highways. Whereas it was once committed in the face of legal prohibition, it is now done under the guise of legal sanction, yet in its newer form it is no less a violation of the public's rights and no less an offense against the public's sense of honesty.

Having, as they think, exhausted every resource for raising money to support political machinery that has grown more quickly than either the population or the business of this rapidly-growing country, our politicians seem to have no scruples against plundering the funds already accumulated from gasoline taxes or against exacting increases in existing gasoline-tax rates in order to meet the deficits in general government expense which they have been willing to let grow to unwarranted proportions. In polite parlance either method may be called "fiscal adjustment," or an effort to "make both ends meet," but both expedients more nearly merit the opprobrious name of highway robbery. Surely the diversion of gasoline-tax funds to uses that were not intended by those who enacted the laws that provided them or by those who paid the taxes required by them is no less serious an offense than the sale of St. Peter's church lands to rebuild the dome of St. Paul's, a trick that our sixteenth century forebears were quick to characterize as "robbing Peter to pay Paul."

In some quarters there has been an improvement in the gasoline-tax-diversion problem, as evidenced by promises to return the "borrowed" money to the gasoline-tax fund. In other states, however, the game goes merrily on, so that the amount of gasoline-tax money diverted to non-highway purposes may far exceed $200,000,000 this year, unless more concerted and more powerful efforts are directed toward the prevention of such misapplication. In some states attempts are being made to increase the gasoline-tax rates, the objective, as frankly stated, being not the building of more highways, but the relief of the distressed. To one with a distorted sense of perspective it might appear logical for the poor to live, as they did in medieval England, "off the highways." To others it will seem that public suffering should be relieved by public charity and not by assessments levied against a single form of activity.

Since September 11, 1929, the largest net paid A. B. C. circulation in the field



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We have made very definite claims regarding Roebling Rope.

We have asserted: (a) that the safety of Roebling Rope is *unsurpassed;* (b) that NO wire rope, regardless of make or construction, will show *lower* general-average operating cost; (c) that Roebling Ropes, incorporating this safety and economy, can be obtained in types and constructions *most suitable* for every wire rope need.

In the first place, these claims are founded on the actual performance of Roebling Rope. Secondly, they are made possible by:—

1. Constant research carried on by the Roebling Laboratory, one of the country's finest, most completely equipped research units.

2. Roebling Acid Steel, custom-made in *small* open-hearth furnaces. Acknowledged by the steel industry to be the finest rope steel made.

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4. Unequalled testing facilities.

When in the market for wire rope, it will pay you to keep these FACTS in mind. They are assurance of utmost wire rope safety and minimum wire rope service cost.

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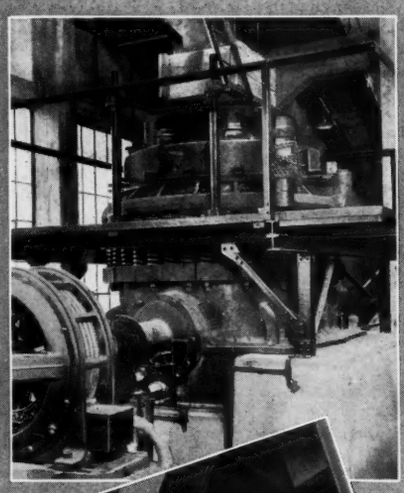
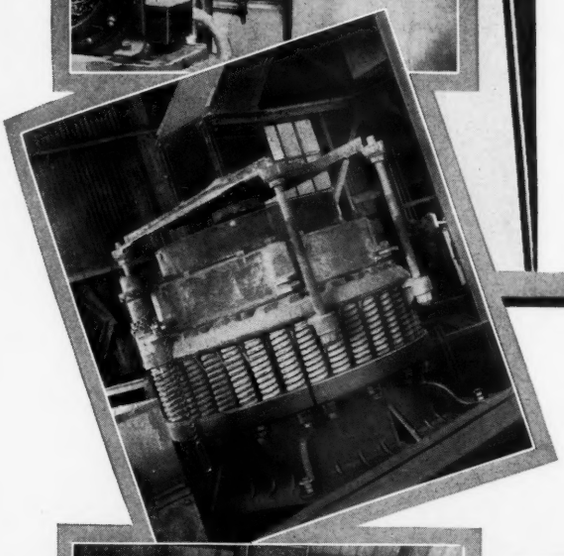
Wire · Wire Rope · Copper and Insulated Wires and Cables
Welding Wire · Flat Wire · Wire Cloth and Wire Netting

Branches in Principal Cities Export Dept.—New York, N.Y.

JOHN A. ROEBLING'S SONS COMPANY

Meeting the growing demand for finer crushed ORE—SLAG—STONE—GRAVEL





YOU too may be confronted with the need of providing a greater quantity of finer product at lower cost. When big tonnages are involved, the cost of fine crushing is all the more a difficult problem if attempted with obsolete, inadequate equipment.

It is for such needs that Symons Cone Crushers were developed. It is in such applications that these crushers have proved that they are without a peer in the field of fine reduction crushing. When almost without exception, the largest producers, those outstanding in their industry, standardize on Symons, you too can depend upon them to serve you best. A better product delivered in the quantity you want and at a crushing cost far below that of any other method of crushing is the kind of performance that can be expected from Symons Cones.

They are built with cone diameters of 2, 3, 4, 5½ and 7 feet, a size for any capacity and any finely crushed product.

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LOS ANGELES
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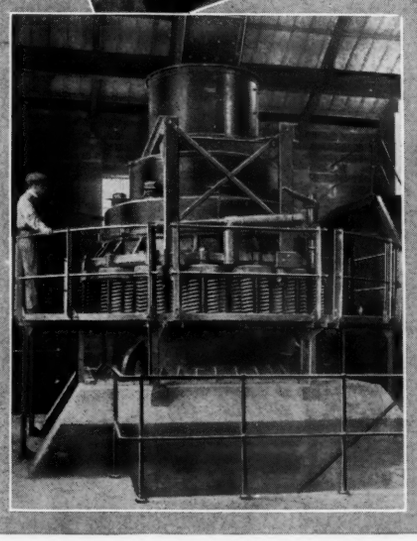
Overseas Office—LONDON, ENG., W.C.2, Bush House



SYMONS CONE CRUSHERS

Pit and Quarry

With which is consolidated
CEMENT-MILL & QUARRY

Volume 24 September 21, 1932 Number 13

MEMBER AUDIT BUREAU OF CIRCULATIONS

Published bi-weekly on Wednesday for producers and manufacturers of Cement, Crushed Stone, Gypsum, Lime, Sand, Gravel and other non-metallic minerals. Entered as second-class matter October 9, 1928, at the Postoffice at Chicago, Ill., under the Act of March 3, 1879.

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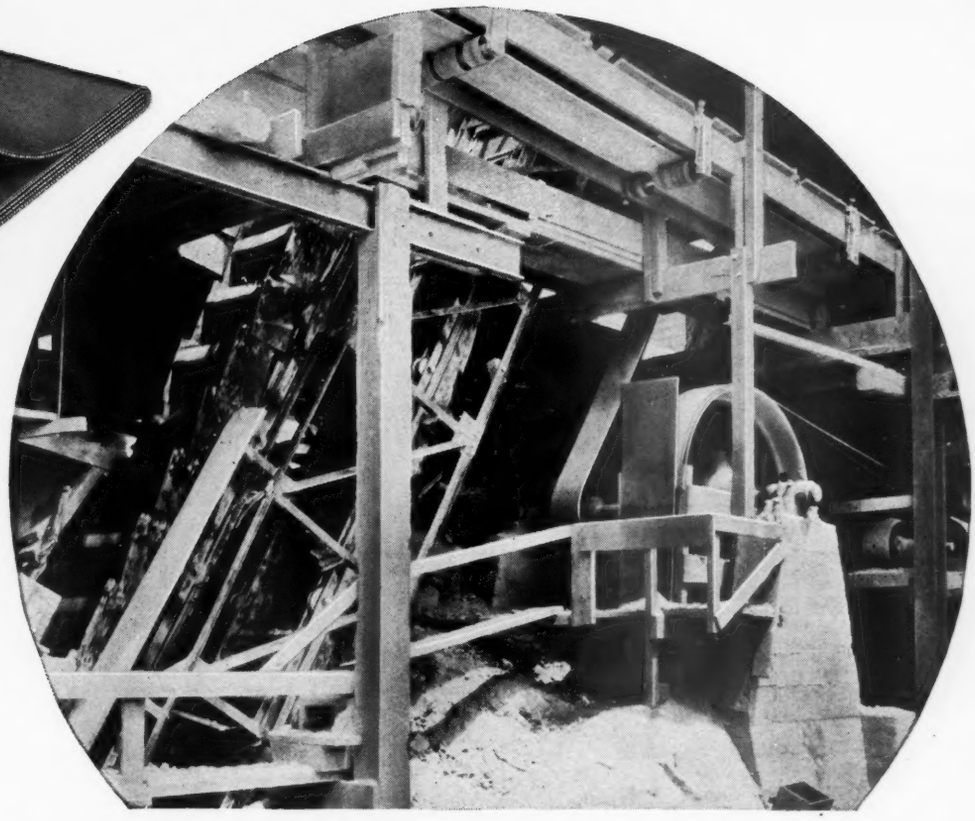
**Goodyear* THOR *Belting, seamless, is made in widths up to and including 16' —* THOR *quality of special construction is available for larger sizes*



The belt that stands up
UNDER CRUSHER-DRIVE SHOCKS

NO OTHER belt stands up like Goodyear THOR Belt, seamless,* under the smashing intermittent shocks of the crusher drive. The records of the rock products industry prove it.

Goodyear THOR is built for severest transmission duty. It is bodied with heavy silver-duck plies, stoutly cushioned and buttressed in high-strength rubber. It is extra strong at the fasteners — has *no center seam** — and is enclosed in *a staunchly protective envelope* that is part of the ply structure of the belt itself.

Goodyear Belts, Hose, Molded Rubber Goods and Packing are scientifically designed and carefully constructed by Goodyear for rock products industrial service, and are accurately recommended for their particular duty in your plant by the G.T.M. — Goodyear Technical Man.

You may save considerable money and much trouble by going over your mechanical rubber goods problems with the G.T.M. Write to Goodyear, Akron, Ohio, or Los Angeles, California, and ask him to call.

TUNE IN: Goodyear invites you to hear the Revelers Quartet, Goodyear Concert-Dance Orchestra and a feature guest artist every Wednesday night, over N. B. C. Red Network, WEAF and Associated Stations

THE GREATEST NAME IN RUBBER

GOODYEAR

BELTS • MOLDED GOODS • HOSE • PACKING

Classified Buyer's Guide

A Directory of PIT AND QUARRY Advertisers Arranged According to Product

Although every effort is made to insure accuracy and completeness in these listings, the publisher cannot accept responsibility for errors or omissions. Any mistakes discovered will gladly be rectified, if brought to the attention of the Advertisers' Service Department.

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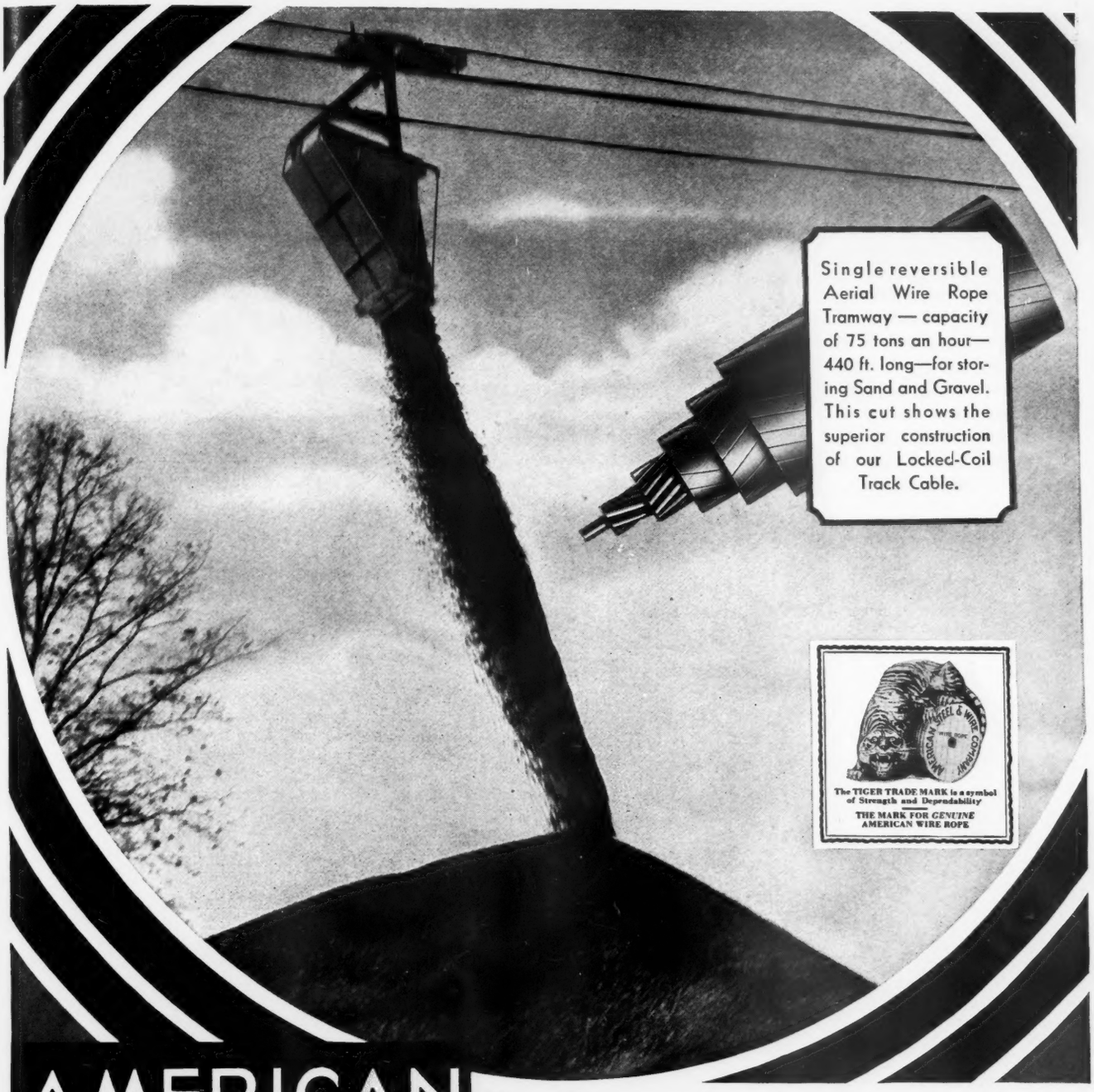
Single reversible Aerial Wire Rope Tramway — capacity of 75 tons an hour—440 ft. long—for storing Sand and Gravel. This cut shows the superior construction of our Locked-Coil Track Cable.
AMERICAN STEEL & WIRE COMPANY
The TIGER TRADE MARK is a symbol of Strength and Dependability
THE MARK FOR GENUINE AMERICAN WIRE ROPE

AMERICAN
STEEL & WIRE COMPANY
AERIAL TRAMWAYS
BLEICHERT SYSTEM

For Storing Sand—Gravel—Stone

To any height—Over any area—At any point
With no structures in the piles
All material reclaimable
In Summer and Winter
With low operating cost
With low maintenance cost
Dependability with long life—in fact
The only way you should store

SAND—GRAVEL—STONE

Estimates of cost submitted gladly. Write us.

1831 MORE THAN 100 YEARS of PROGRESS IN WIRE MAKING **1932**

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago
94 Grove Street, Worcester

SUBSIDIARY OF UNITED STATES STEEL CORPORATION
AND ALL PRINCIPAL CITIES

Empire State Bldg., New York
First National Bank Bldg., Baltimore

Pacific Coast Distributors: Columbia Steel Company, Russ Building, San Francisco

Export Distributors: United States Steel Products Company, New York

PROOF
Maintenance Cut to a Fraction

These unretouched photographs show the impeller of a Hydroseal Dredge Pump after 680 hours of service. 200,000 tons of finished gravel were handled by this impeller, which, allowing for waste, means that between 400,000 and 500,000 tons passed through the pump, in sizes as large as 8" cube. Note in the photograph showing the suction side of the impeller, that while the runners and the inside of the shroud of the electric alloy steel impeller have been gouged out by the gravel, until they are too thin for further use, there is absolutely no sign of wear on the outside of the shroud. The outside of the shroud on the engine side of the impeller also was not affected. These photos thus undeniably prove that hydrosealing functions perfectly, preventing abrasive wear at these points and assuring continuance of the initial high efficiency of the pump through the entire life of the impeller. Instead of the expected wear on both sides of the impeller, as in ordinary pumps, the wear is on one, the inside alone. Since no wear occurred on the outside shrouds of the impeller, it is evident that the sideplates of the pump were likewise unaffected. With a new impeller, the efficiency maintained by the first impeller will be continued. The Allen-Sherman-Hoff Company, 215 South Fifteenth Street, Philadelphia. Offices in Principal Cities.

HYDRO SEAL

VOLUME 24 NUMBER 13

Pit and Quarry

With which is consolidated

CEMENT-MILL & QUARRY

CHICAGO, SEPTEMBER 21, 1932

Building Shows 4% Increase in August

CONTRACTS TOTAL $133,988,000

August contracts for new construction of all descriptions awarded in the 37 states east of the Rocky Mountains showed a gain of 4 per cent. over July awards according to F. W. Dodge Corp. The August figure of $133,988,100 compares with $128,768,700 for July and $233,106,100 for August, 1931. Gains over July were shown in building, both residential and non-residential, as well as in engineering works. The contract total for engineering works was only 12 per cent. smaller than the total shown for this class of construction during August, 1931.

Contract totals reported for August in New England, metropolitan New York, up-state New York, the Pittsburgh area, the Southeast, the Chicago and the New Orleans territories were larger than those recorded in July. Of these major territorial areas the southeast reported a gain, also, over August of last year. Though the remaining six territories failed to score advances over July, gains over August, 1931, were reported in the Middle Atlantic states and the Central Northwest.

For the first eight months of 1932 total construction awards in the 37 eastern states aggregated $929,836,500 as compared with $2,311,598,100 for the corresponding period of 1931. Of the current year's total to date $203,205,600 was for residential building; $361,085,100 was for non-residential building; and the balance was for public works and public utilities.

States Award Contracts for Much Road Mileage

Quick action in making use of the $120,000,000 emergency federal-aid loan will soon place thousands of men at work. Minnesota already has made tentative awards for the construction of 129 miles of concrete pavement with her share of the loan fund. New York has slated 190 miles of concrete for early building; Illinois, 210 miles; Nebraska, 57 miles; Oklahoma, 109 miles; and Georgia has let contracts for 66 miles with lettings soon to be made for $2,500,000 worth of additional road betterments.

At its meetings September 18 and 19 the Texas Highway Commission was scheduled to open bids and award contracts for highway construction estimated to cost approximately $10,000,000. The program calls for improvement of 1,207 miles, including 505 miles of grading and drainage structures and 702 miles of paving.

Equips Three Plants for Quick-Hardening Cement

★ Equipment for producing a new temperature-resisting cement for producing quick-hardening concrete is being installed in the Toledo, York, Pa., and Manitowoc, Wis., plants of the Medusa Portland Cement Co., according to E. J. Maguire, vice-president.

The additions are entailing the expenditure of several thousand dollars and will be completed this fall. Experimental strips of concrete paving employing the new product have been tested by the Pennsylvania Department of Highways and are said to have proved highly successful.

Creek-Diversion Project Will Cost Over $300,000

★ The Tennessee Coal, Iron & Railway Co., of Birmingham, Ala., has awarded contracts for excavation and other work in connection with the diversion of Valley Creek around its dolomite quarry at Delonah, Ala.

More than $300,000 will be spent on the project, it is reliably reported.

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★ **Meet Competition by *Beating It!***

Items in the news section marked with a star call attention to those alert producers who are awake to the arrival of an era of good business and who are expressing their faith in the future by buying and installing their necessary equipment NOW.

★★★★★★★★★★★★★★★★★★★★★★★★★★

New California Plant Rises in Record Time

HAS MILLION-TON CONTRACT

★ The Consolidated Rock Products Co., leading aggregates producer in the Los Angeles area, has just started operations at its new plant constructed on the site of the old Live Oak plant which was built in 1911 near Azusa, Cal. From 35 to 50 men will be employed.

This plant was rushed to completion by a staff of 200 workers in a little over two months. It has been built to turn out special sizes of crushed stone for the Pasadena Dam. Specifications call for stone from 5 to 7 in. in diameter. The plant has a capacity of 3,000 tons per 10-hr. shift.

The Pasadena Dam contract calls for nearly a million tons of material. The company will ship over the old flood control railroad with its own motive power to the mouth of the canyon. There, the stone will be carried by aërial tramway for a distance of three miles up the mountainside, the rock being conveyed in 1-cu. yd. buckets over the tramway.

Death Takes Two Gravel Producers in Midwest

Two well known sand-and-gravel producers in the middle-west died recently.

R. H. Eastwood of Grayville, Ill., passed away at a hotel in Colorado Springs, Colo., death being due to heart disease. He was president of the Eastwood Sand & Gravel Co., of Grayville.

James W. Thompson, 66 years old, president of the Wabash Sand & Gravel Co. of Terre Haute, Ind., died at his home at the Plaza Hotel, of which he was proprietor, on August 31 following a lingering illness.

Cement Plant Closed to Repair Two Rotary Kilns

The plant of the Yosemite Portland Cement Co., at Merced, Cal., has been closed for a 60-day period while the two rotary kilns are being repaired.

Shipments are being made from stock meanwhile.

Proposed Waterway Meets With Disfavor

CEMENT MILLS FEAR IMPORTS

One immediate effect of the opening of the St. Lawrence waterway would be to subject about 30 cement plants in the Great Lakes region to the same Belgian price-cutting competition faced by plants on the Atlantic seaboard, the *Buffalo Times* points out.

Altogether the cement plants in the Great Lakes region employ more than 6,000 persons and have payrolls of more than $2,000,000.

Any foreign price-cutting in the Great Lakes region would inevitably unsettle all the existing commercial machinery now utilized in the manufacture of cement and jeopardize the jobs of many cement workers.

A study of recent hearings before the United States Tariff Commission on the question of a protective tariff for cement shows what the cement manufacturers might expect.

The Atlantic seaboard manufacturers complained before the tariff commission that Belgian manufacturers with their price-cutting tactics had forced a large section of the American cement industry to market its product below cost.

The record of that tariff hearing shows that Belgium was laying cement down on the Atlantic seaboard at a rate of $1.47 per bbl., while the lowest price the American manufacturers, who did not have available the same cheap labor used by the Belgians, was $1.98, giving the Belgians a spread of 51 c. per bbl.

Three Plants to Install Dust-Collecting System

★ A complete dust-collecting system and a new separating and grading installation have been made at the plant of the Tavern Rock Sand Co., at Klondike, Mo. The equipment and installation were made by the Northern Blower Co., of Cleveland, O.

Two other contracts for complete dust-collecting systems were recently placed with the company. The Llanerch Quarries at Llanerch, Pa., operated by Vincenzo Di Francesco, and the Attapulgus Clay Co., at Attapulgus, Ga., are the firms which placed the orders. The last-named concern will utilize the equipment in connection with its fullers'-earth grinding equipment.

Iowa Producer Building New Road-Stone Plant

★ A complete washing and scrubbing plant for producing crushed stone is being erected by the Dubuque Stone Products Co., of Dubuque, Ia., primarily for the purpose of supplying aggregates to Wisconsin specifications.

The stone will be employed in connection with a contract the company closed recently for supplying the material and is to be used for road-building, the state of Wisconsin having a large construction program in progress, with considerably more mileage to be surfaced next season.

Woman Gravel Producer Acquires New Excavator

★ A new Bucyrus-Erie Model 1020 shovel has been purchased by the Frederick Co., of Johnstown, N. Y., to be used for stripping as well as excavating in the pits at the company's sand-and-gravel operations.

The Frederick Co., in addition to producing sand-and-gravel, is an important retailer of coal in Johnstown. The company is headed by Mrs. Almeda Moynehan, and Mrs. Moynehan takes a very active part in directing the affairs of the concern. Frank Waterman is general superintendent.

Midwest Dealers to Seek Uniform 2-Cent Gas Tax

Dealers in Nebraska, Kansas, Iowa and Missouri have organized to work for a uniform gasoline tax of 2 c. a gallon, without exemptions and without diversion of the income to other than highway work. Independent dealers from these four states will meet October 25 in Kansas to draft a campaign.

Their spokesmen say the 2 c. rate is sufficient, now that the government has added a federal tax of 1 c. They declare that the 2 c. tax in Missouri brings in more revenue than 3 c. in Kansas. Gasoline bootleggers are active in running shipments by truck from the lower-tax states and have demoralized the trade close to state lines. The Iowa tax is 3 c. and in Nebraska it is 4 c.

Nebraska gasoline tax collections declined sharply the first six months of the year to $3,611,000 from $4,238,000.

Fake Concrete Formula Being Offered for Sale

Producers of ready-mixed concrete are said to have been called upon in the Chicago area recently by a smooth-tongued promoter traveling under the name of F. A. Harris, "consulting research and analytical chemist of 84 City Road, London, England," who attempts to sell a formula for making concrete more dense, stronger and of greater plasticity. His price for the formula is reported to be $25, and investigation has shown it to be worthless.

Warnings to producers regarding his activities were issued recently by the Chicago Better Business Bureau.

News Briefs

Operations resumed at Hiawatha gravel plant at Iron River, Mich., by M. A. Hanna Co.

* * *

Silica Co. of California acquires new sand pit at Brentwood, Cal., K. G. Schwegler, manager, reports improvements costing $12,000 in progress.

* * *

Despite drop in motor-license fees, two states—Missouri and Maine—report increased gasoline-tax receipts as compared with 1931.

* * *

New loading equipment installed in quarry of Ottawa Stone Co. at Ottawa, Ill.

* * *

Night shift put on at Federal Materials Co. quarry at South Cape Girardeau, Mo., to facilitate production of stone for government revetment work on Mississippi River.

* * *

New sand barge ready for launching at Missouri River Sand & Gravel Co., Boonville, Mo.

* * *

Zoning commission of Yonkers, N. Y., rejects petition of Yonkers Rental Corp., to construct crushed-stone plant within town limits.

* * *

Wisconsin Industrial Commission reports that total compensation of $220,000 has been paid to men affected by silicosis in Wisconsin industries during the last three years.

* * *

Order for 2,000 tons of stone for road building being filled by Tressel Stone Co., Ada, O.

* * *

Battery of three Diesel engines installed at new plant of Hudson River Stone Corp., Cold Spring, N. Y.

* * *

Michigan Alkali Co., Wyandotte, Mich., begins producing solid carbon-dioxide at lime plant.

Two Crushers Installed in New Limestone Plant

★ Construction is proceeding on the new plant and quarry of the Lime Products Manufacturing Co., at Falls City, Ore.

Two Universal crushers were recently installed and will be ready to operate shortly, it is reported. The company plans to concentrate on the production of agricultural limestone.

The Johns-Manville Corp., producer of asbestos and manufacturer of asbestos products, has announced plans for the erection of an exhibit building at Chicago's 1933 World's Fair. The building will be constructed almost entirely from materials produced by the Johns-Manville concern.

Highway and Building Congress Notes

Another organization, the Associated Equipment Distributors, has joined forces with the ten other associations who will participate in the Highway and Building Congress to be held January 16-20, 1933, at Detroit.

Conservation of highway revenues for highway purposes only will be one of the urgent problems facing the Congress. In the meantime, producers should leave no stone unturned to fight any attempt in their state to divert motor-vehicle and gasoline-tax funds for other purposes.

All convention sessions of the National Sand & Gravel Assn., National Ready Mixed Concrete Assn., and National Crushed Stone Assn. will take place at the Book-Cadillac Hotel. Special rates, both for rooms and for meals, will be offered. As in the past, the railroads will provide reduced round-trip rates to Detroit.

Cement-Products Maker Erects New Gravel Plant

★ A new sand-and-gravel plant has just been placed in operation at Marietta, O., by the Marietta Concrete Co. Six sizes of washed sand and gravel are being produced, some of the product being used by the company in its manufacture of cement products, the remainder being sold.

The plant was designed by Elmer Gray, chief engineer of the firm, and replaces an old operation. It is completely electrically driven and is of steel-and-concrete construction. Excavation is done by a drag-line.

Opens Kentucky Quarry to Supply Federal Job

A quarry has been opened near the Cumberland River at Smithland, Ky., by the Franklin Limestone Co., of Nashville, Tenn., for the purpose of producing rip rap and spalls to be used by the federal government in revetment work along the Mississippi River.

W. C. Rodes is superintending the operations.

New York Council Makes Gas-Tax Recommendation

H. V. Owens, president of the National Sand & Gravel Assn., and chairman of the executive committee of the New York State Construction Council, reports that the Council has definitely recommended that a two-cent gasoline tax, plus motor-vehicle fees, will provide sufficient revenue to care for the state's entire highway program, provided the funds are not diverted to some other use.

The above plan would yield $72,000,000 per year, it is estimated, and would be sufficient to take care of all new construction and maintenance.

Modernization Program On at This Lime Plant

★ The Western Lime & Cement Co., of Milwaukee, is erecting an addition to its lime plant at Green Bay, Wis., for the production of hydrated lime.

According to V. F. Nast, secretary and sales manager of the company, the plant will be one of the most modern lime-producing units in the central northwest when the improvements are completed, and the only plant making high-calcium lump and hydrated lime in Wisconsin.

Ontario to Hire 1,000 Men to Build Highway

Construction is about to begin on a new highway connecting Hamilton, Ont., Can., with the Peace Bridge at Fort Erie, opposite Buffalo, N. Y. The section to be built is 26 miles long, 15 miles of which will be of concrete and 11 probably of asphalt. The cost is estimated at $500,000. About three months will be required to complete the road, employing approximately 1,000 men. Construction is under the jurisdiction of Hon. Leopold Macauly, Minister of Highways of Ontario, Toronto, Canada.

Travertine Deposit in Montana Being Stripped

The Northern Pacific R. R. is showing considerable activity in the development of its travertine deposit at Gardiner, Mont., having installed one of the world's largest steam shovels for removal of overburden covering the deposit.

From all indications the exploitation of these marble deposits represents the first stepping stone in the development of Montana's vast stores of nonmetallic minerals and will be one of the factors in helping this state to solve some of its unemployment problems.

Buys Structural Steel to Rebuild Lime Plant

★ Contract for approximately 385 tons of structural steel has been awarded the Burger Iron Co., of Akron, O., by the Kelley Island Lime & Transport Co., of Cleveland.

The material is to be used in making extensive improvements and alterations at the Kelley Island lime plant at Clay Center, O., according to official advices from the company.

Committee C-9 Busy on Research Program

OVER 100 ITEMS ON DOCKET

Committee C-9 on Concrete and Concrete Aggregates of the American Society for Testing Materials has more than 100 items listed in its docket of current activities. It is quite apparent that there is much work to be done in research and standardization in this field. Some of the more important items are outlined below.

The subcommittee on strength tests has studies in progress on methods of capping, on loading beams, and a method of measuring cores drilled from a concrete structure. A suggested standard test method for permeability and the standardization of test methods for absorption are active projects of the subcommittee on permeability. The subgroup on aggregates has more than 20 items listed, including studies of soundness, abrasion, light weight types, etc. Standardization work involves tests to ascertain the amount of soft and rotten particles, specific gravity, alternate mortar test for sand, etc. The subcommittee on extraneous substances in concrete is working on the effect of mica in sands, effect of organic matter and oil-bearing aggregates and a standard color solution.

Several other subgroups of Committee C-9 have important problems before them. The subcommittee on admixtures is developing a method of measuring unit weight and the normal consistency of these materials. A standard method of test for determining volume changes in concrete is being worked up by the group covering elasticity and volume changes. The subcommittee on durability has several items to forward, including the development of test methods for measuring durability and the method of making freezing-and-thawing tests. A proposed method for this latter project was appended to the annual report of Committee C-9 presented at the recent A. S. T. M. annual meeting. Consideration is being given by a subgroup to proposed tentative specifications for ready-mixed concrete.

The following officers were newly elected at the recent meeting of the committee: Chairman, R. W. Crum, director, highway research board, National Research Council; Vice-Chairman, Stanton Walker, director, engineering and research division, National Sand and Gravel Assn.; Secretary, R. R. Litehiser, chief engineer, Bureau of Tests, Ohio State Highway Dept.

Nearly 700 bbl. of cement has been donated by the Universal Atlas Cement Co. for constructing a swimming pool for the colored population of Gary, Ind. The cement was shipped from the company's plant at Buffington, Ind., a short distance from Gary.

Editorials

The Dangers of Hand Labor

THE instructions of the Bureau of Public Roads requiring the use of hand labor in the building of roads partly financed by federal-aid money are being accepted in too many places with the resignation and indifference which characterize the general American attitude toward ill-advised political action. Too many are content to believe that, in this as in other cases, time will cure all things and that the follies of the government ruling will become so evident that the requirement will collapse of its own weight. This type of faith is not justified by any of the common experiences of life, least of all, one might say, in the field of politics, where the ideal of the "general good" is but the bait by which the gullible public is caught on the hook of political expediency.

The use of hand labor, even on the most modest scale that a loose interpretation of the requirements could defend, will retard the progress of road-building to a greater extent than will probably ever be known. From Oregon comes the report that the use of hand labor has been found so costly that in one case not less than eight miles of highway could have been built for the money expended on a single mile of hand-constructed roadway. While we do not consider this a typical instance, we do believe that the cost of hand-built roads will greatly exceed—possibly by anywhere from 50 to 300 or more per cent.—the cost of highways built by the use of the most efficient road-building machinery available. The common experience of Michigan and Washington, to cite but two cases, shows how wasteful the hand-labor program can be. In some states, fortunately, most of the federal-aid money was expended before the government's silly ruling was made effective, but in the great majority of states the bulk of the federal contribution is yet to be spent and, so, is subject to the hand-labor specification.

It is not difficult to conceive the serious setback which will be given to road-building programs everywhere if the hand-labor ruling is applied as intended. If hand-labor roads cost, on the average, only twice as much as machine-built roads—and who, familiar with the high cost of hand work, would consider this a rash estimate?—it is obvious that we can not construct even one-half of our projected mileage in the allotted time. The development of highway transport, the demand for road-building materials, the need for the type of labor employed in the making of machine-built roads, the requirement for mechanical equipment and the services of those who manufacture it—all these highly important economic values will be impaired to precisely the same extent.

In one locality, we are informed, the district engineer of the state highway department has refused to abide by what he terms a "foolish rule." He is reported to have said that the taxpayers have threatened to obtain a court injunction to prevent the waste of their money through the use of methods that are more costly than the best methods available. While this instance may not be—and we believe is not—typical of the attitude of taxpayers everywhere, we are confident that the waste of the taxpayers' money by all branches of government service—federal, state, county and municipal—has aroused public opinion to the point where sentiment can be crystallized and the restraining hand of good sense applied.

The demand for the use of machinery to the fullest extent is not prompted solely by the selfish desires of special interests. Highway users, highway builders, highway-material producers, the makers of highway-building machinery, and the hundreds of thousands of workers whom these varied groups employ depend upon the continued development of highway building, improvement and maintenance. They are not merely a large share of the public; they are the public; their interests penetrate into every form of commercial activity and whatever affects their interests adversely affects the common good adversely. Wholly aside from the sorry spectacle of twentieth-century men advocating a return to primitive methods of construction, the demand for hand labor in road-building is an act of economic retrogression and, unless it is checked and ultimately frustrated, will provide a strong precedent for the adoption of outmoded methods in other fields of industry whenever and as long as employment is —and when is it not?—a serious problem.

Distress Buying Brings Distress Selling

FOR a long time many forward-looking business men, in our industries as well as others, have realized that there could be no worthwhile revival of business unless there was a general raising of price-levels. But they have not been so quick to see that there could be no raising of prices as long as buyers insisted on lower prices. The difficulty has been due largely, no doubt, to the average man's inability to realize that he is both a seller and a buyer and that, therefore, he can not expect to buy cheap and sell dear and keep the country's industries on a sound footing. The business man who is willing to pay the price asked of him is more likely to sell at a price that will net him a profit than the man who insists on cut prices on everything he buys and, therefore, is ready to sell his own product on the same terms.

We agree with C. D. Garretson, president of the Electric Hose & Rubber Co., who believes, according to his article in the *Nation's Business*, that the responsibility for the continuance of business sluggishness lies with manufacturers, producers and

distributors. On them he places the blame for sacrificing profits in a vain attempt to maintain volume. He deplores the fact that, although everyone knows that business can not revive until prices rise, buyers continue to clamor for lower prices and refuse to buy unless they get them, while producers, on the other hand, vie with one another in their attempts to meet the buyers' demands. As a result, the country's business is demoralized and is suffering a daily loss of millions of dollars because producers and manufacturers, who have the control of the situation in their hands, do not stop the enormous leak that comes from selling their products at a loss.

The producer in our industries who insists on buying his supplies, his replacements, and his new equipment at prices that do not allow their manufacturers a profit is contributing to the perpetuance of the vicious system of "chiseling" of which he complains so loudly when his prospective customers insist upon profitless prices on the materials they want to buy. On the other hand, in expressing his willingness to allow those from whom he buys to make a reasonable profit on their goods, he establishes a principle from which he is not likely to draw back when he is faced with the problem of deciding between profitless and profitable prices on his own products. Therein lies the key to the remedy for which all forms of business seek. If, through a mistaken notion of the value of volume—even profitless volume—producers in all lines continue to offer their products at prices below the profit-level, nobody will be making a profit and, as experience has only too clearly shown, nobody will be getting the much-desired volume. The trick of price-cutting does not accomplish the result it is hoped to gain and, in addition to its futility, ruins those who practice it. Those whom it deceives it also destroys.

Size and Success

IT is a fact of common notoriety, as we have frequently pointed out, that small businesses exhibit a higher percentage of survival in times of business stress than do their larger rivals, yet the lesson to be learned from such frequent and recurring evidence has apparently escaped unnoticed. The remarkable adaptability of the small concern, its ability to adjust itself to rapidly changing conditions, is one of the small operator's chief advantages in the competitive sphere. In the same conditions the high degree of immobility of the large concern, its unwieldiness and the consequent difficulty of rapidly shifting into new positions manifold forces that are widely deployed, is a tactical disadvantage of great importance in times of emergency. This truth has not yet been perceived by countless directors of large businesses who, while they complain bitterly of small-scale competition and its serious inroads on their markets, continue to nurse the fallacy that times of business hardship, such as we have recently experienced, will eliminate that competition and so solve their problems.

A survey was recently made of 1,130 companies in the United States and Canada. This group included 44 different industrial classifications, and the data studied covered a period of 20 years and presented more than 14,000 company-year cases. Of the nine industries examined, only one disclosed any material advantage in profit-earning efficiency on the part of companies of large size, and that is hardware manufacturing. In one other industry, that of machinery manufacturing, the sizes of the companies investigated apparently had little effect on profit-earning ability. But in every one of the other seven industries studied whatever advantages in earning power were found to exist belonged to the concerns of small size, and in five of those industries every increase in size was followed by a tendency toward lower profit rates.

According to the results of this survey, increasing size has an adverse effect on earning capacity. The larger fixed investment becomes, the more difficult it is to maintain the original rate of earnings. In other words, here as elsewhere, the law of diminishing returns operates to check overexpansion, it being impossible to increase profit-earning capacity in proportion to manufacturing or producing capacity. The existence of this fact is almost invariably shown —even when it is not recognized—in the reduced profit per unit of product and in the reduced profit per unit of capital investment which result as businesses are enlarged. It is common experience to discover that not only do the production costs per unit of product decline with the increasing production made possible by increased investment, but that the realizable profit declines at an even faster rate, so that while gross profits may be larger, the profit-rate is smaller. When the volume of business shrinks, the small concern, arranged to earn a fair product-unit profit on small volume, finds its situation little disturbed by changed conditions, whereas the large concern, whose profits are dependent on large volume at small unit profit, struggles, often unsuccessfully, to free itself from the burden of huge fixed investment charges, which, not having been written down to the bases of current values, make it virtually impossible to produce at a profit on low-volume schedules.

There are many advantages that accrue from large-scale production—low unit costs of production, large buying power, extension of markets, and the like—but great profit-earning capacity is not one of them. The more extended a concern's operations—the more dependent it is upon wide-flung markets—the more open it is to the attacks of small-scale competition because the less able is it to adjust itself to the new situation, either by withdrawing from fields in which its competition does not operate or by escaping from the load of fixed investment. The data presented in the survey referred to give no encouragement whatever with respect to greater earning power to those who believe that their commercial salvation lies in great expansion; indeed, they point with certainty, so far as these observations go, to the apparent truth that large size is a detriment and not an advantage.

Portable Plants Supplement Established Operations of Gifford-Hill Co.

By W. E. TRAUFFER

THE operation of portable plants in conjunction with permanent plants is a subject which has recently been receiving considerable thought from aggregate producers. Many have found in this period of intense competition that they are unable to ship aggregates at a profit to as great a distance as was formerly possible and that they, therefore, are losing a good deal of business to portable plants. Most of this demand is for construction projects which would not justify the construction of a permanent plant. This situation exists to the greatest extent in the sparsely settled western and southwestern states, where plants and construction projects are usually far apart.

The Gifford-Hill & Co., Inc., of Dallas, Tex., one of the largest producers of sand and gravel in the country, was one of the first to see the advantages of this type of operation. The company was originally a railroad contractor operating small portable gravel plants for ballast. In 1925 the first permanent plant was built at Forest Hill, which is 25 mi. southwest of Alexandria, La., to furnish material for this purpose. Operations were gradually expanded until to-day the company operates 11 sand-and-gravel plants in Louisiana, Texas and Arkansas and a crushed-stone plant in Texas.

Most of the company's plants are permanent operations, but the company also has a number of portable and semi-portable plants which are moved from place to place as business demands. A typical plant of this type is the one used at Roanoke, Tex., last year to supply aggregates for a highway-paving job. This operation was completely described in the April 6, 1932, issue of PIT AND QUARRY.

The second Louisiana plant of the company was purchased in June, 1930, from the Belle Cheney Sand & Gravel Co. which had built it earlier in the year. This plant was rebuilt and changed to a dredging operation. It is located at Turkey Creek, which is 28 mi. south of Alexandria. The company's third Louisiana gravel plant was put in operation in June, 1931. It is located near Searcy, La., which is 45 mi. northeast of Alexandria. These three plants are described in this article.

Forest Hill Plant.—The original ballast plant at Forest Hill was supplied by a 2-yd. drag-line when it first went into operation in 1925. Early in 1926 there was some demand for road material as well, so it was decided to build a new and larger plant with a dredge. Both the dredge, the *Edna May*, and the plant were Diesel-engine-driven and were designed by W. H. K. Bennett. Later in the year a new dredge, the *Marjorie*, with a temporary gravity-type plant, was built to satisfy the rapidly-growing demand. Both dredges were equipped with 50-ft. Diamond cutter-ladders.

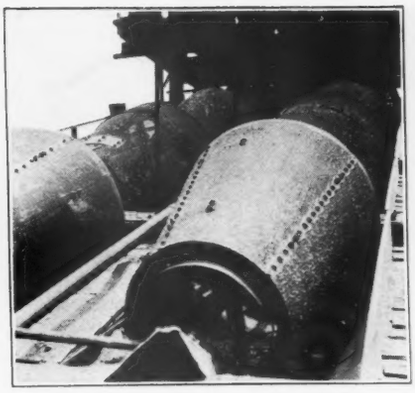
No other important changes were made until 1930, when the entire operation was electrified. A new dredge, the *Catherine*, was then built and the *Edna May* was used to supply the portable plant. The two newer dredges supplied the main plant, one being used as a "booster" when operations got too far from the plant. Later both boats fed a scraper and belt-conveyor system, which was abandoned when operations again got too far away. Several portable plants were then used until the deposits were finally worked out on that side of the plant.

Early in 1932 a new pond was opened on the opposite side of the plant. At the same time a concrete dredge-discharge sump, with a "booster" pump, and a new belt-conveyor and flat screen were installed at the plant. The new pond has about 10 ft. of clay overburden which is stripped by a P&H drag-line fitted with a Page bucket and is hauled away in trucks. The gravel deposit is about 50 ft. deep with 10 ft. above water-level. It averages about 70 per cent. sand, with coarser material near the bottom.

The dredges *Catherine* and *Marjorie* work independently in this pond. Both have wooden hulls with water-tight bulkheads and cutting ladders. The *Catherine* has a 12-in. Amsco pump driven by a 300-hp. G. E. motor. A 3-drum Clyde hoist operates the ladder and two shore lines. The *Marjorie* has a 10-in. Diamond pump, driven by a 300-hp. Allis-Chalmers motor, and a 3-drum Clyde hoist handles the ladder and shore-lines. Both dredges have 20-hp. motors for the ladders and hoists. Hewitt Gutta Percha suction hose and Crouse-Hinds conduit are used.

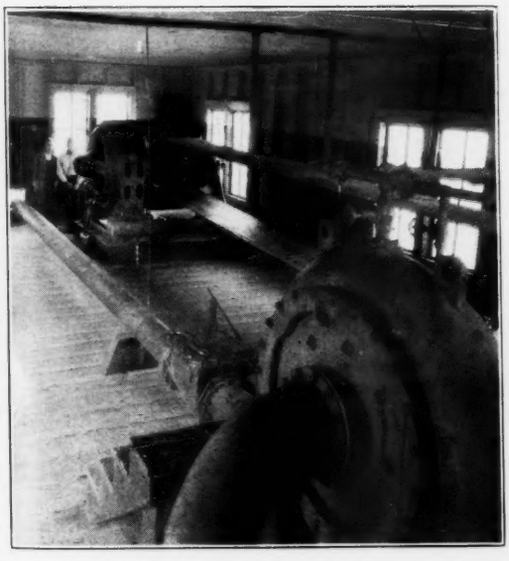
Both dredges discharge through individual pipe-lines supported on

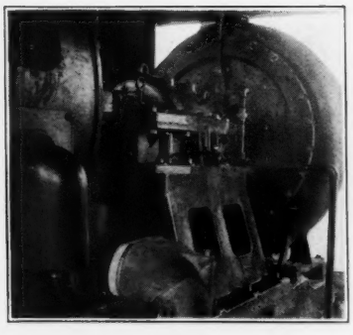
Wright-motored biplane used by Gen. Supt. L. E. Reel to enable him to keep in close personal contact with the company's many operations.

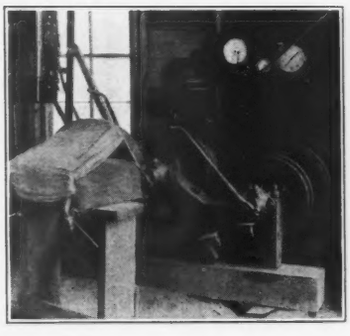


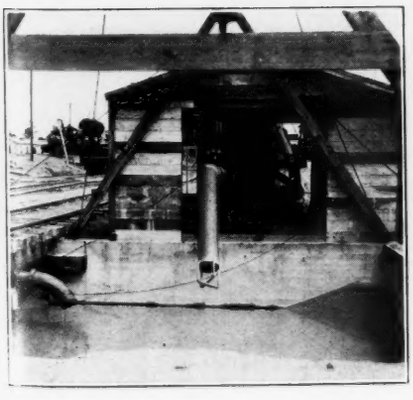
FOREST HILL PLANT

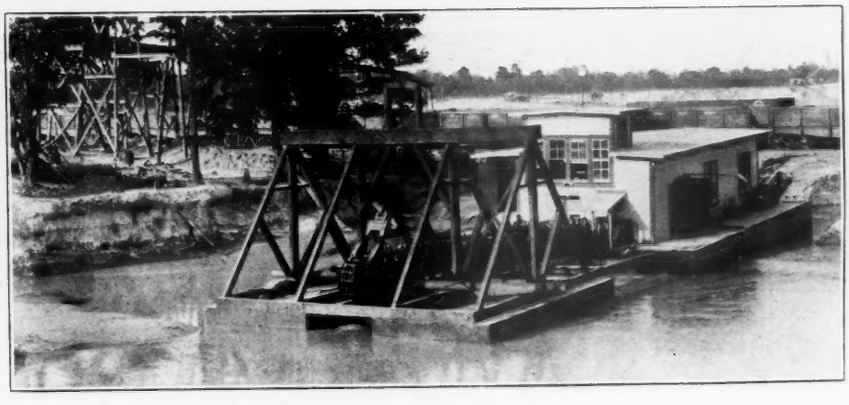
Top, left—Dredges at work in the pond with plant in background. *Top, right*—Close-up view of the sizing screens. *Below*—The 10-in. dredge pump and motor on the dredge "Marjorie." *Right*—A general view of the plant. Immediately below, the two small pictures show the sump pump and the hoist which handles the intake nozzle of the sump pump. *Bottom, left*—A view of the sump. *Bottom, right*—The dredge "Marjorie," showing the cutting ladder.

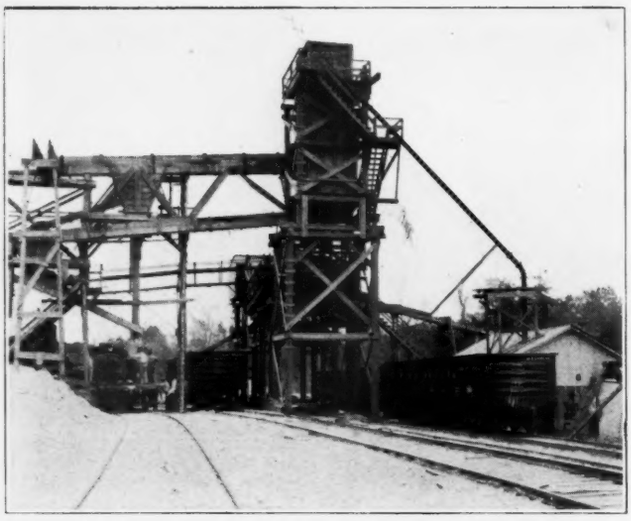


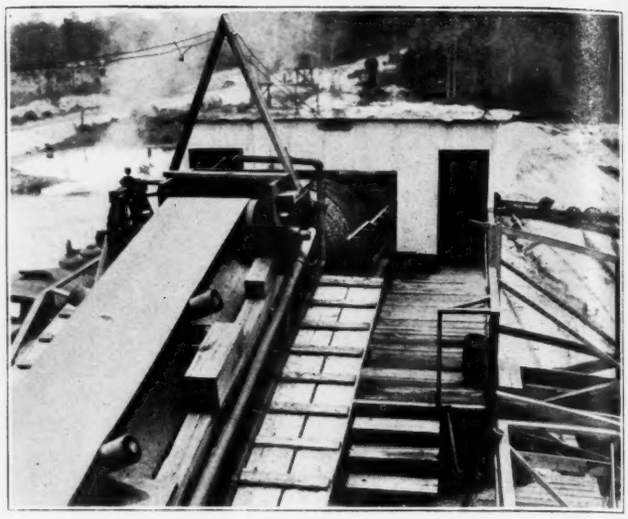


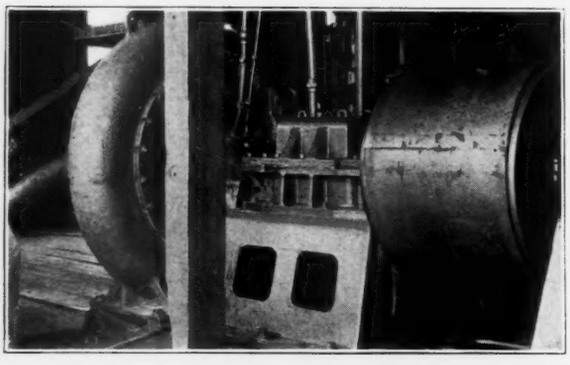


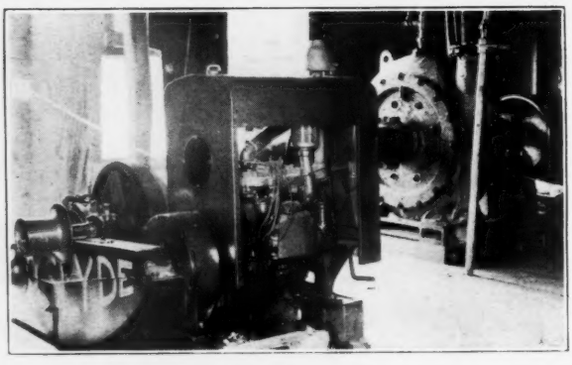






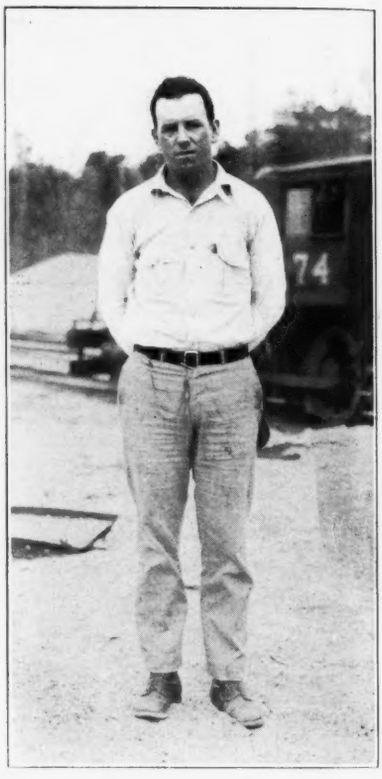


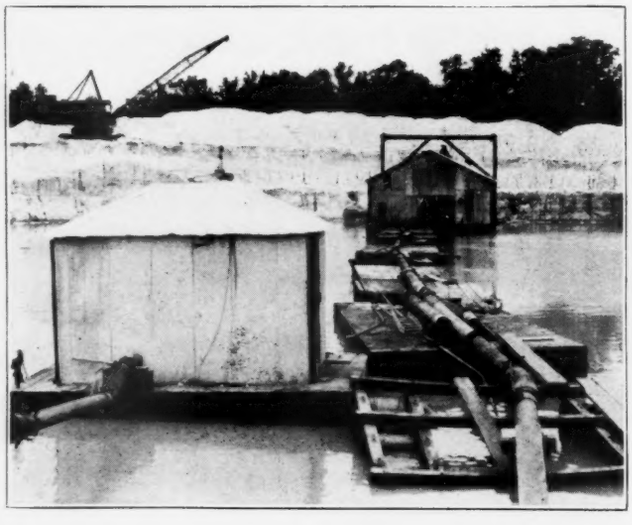


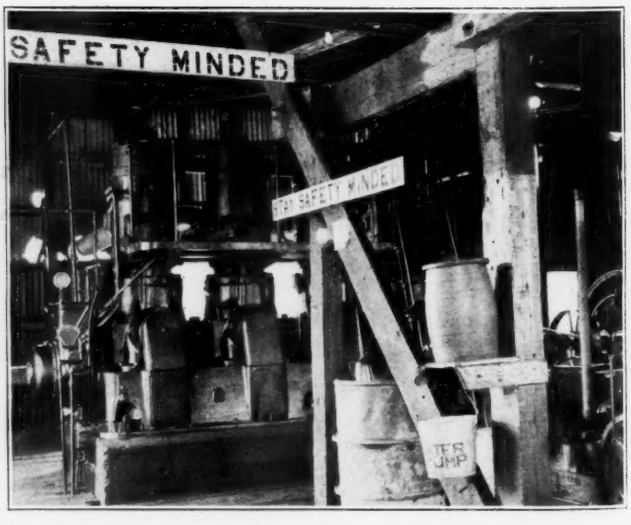


TURKEY CREEK PLANT

Left, reading down —A general view of the plant. The dredge pump and drive. Sump pump and the gasoline-driven hoist. Dredge pond with drag-line stripping the bank and floating pump-house in foreground. *Right, reading down*— The picking-belt conveyor and sizing screen. Emory Grayson, superintendent. The 4-cyl., 240-hp. Diesel engine on the dredge.







wooden pontoons into a concrete sump, 30-ft. square and 12-ft. deep, at the plant. The dredges are now pumping a distance of about 300 ft. against a 30-ft. head. The sump is necessarily of concrete, as the sandy soil would otherwise allow the water to seep back into the pond more rapidly than the dredges could supply it. An overflow in the sump allows excess water to drain back into the pond. A 24-in. pipe-line allows water to pass by gravity from the worked-out pond to the new pond, which is considerably deeper.

The "booster" pump is housed in a wood-frame building alongside the sump. The intake nozzle is suspended from a timber A-frame over the sump and is handled by a 2-drum Novo hoist driven by a 10-hp. G. E. motor. The 10-in. Amsco "booster" pump is driven by a 250-hp. Allis-Chalmers motor. Hewitt Gutta Percha suction hose, Crouse-Hinds conduit, and a Bristol recording pressure-gage are used.

The "booster" pump discharge-line is carried on an inclined timber trestle to a 12-ft.-square rubber-lined wooden box which breaks the force of the flow. This pump carries the material a distance of 440 ft. and elevates it 42 ft. The material and water then pass over an inclined stationary screen, fitted with ⅜-in. Rol-Man manganese wire cloth, where it is also thoroughly washed. The material passing through this screen goes to a wooden settling tank where the amount and fineness of the sand produced can be controlled. The sand is loaded directly into cars for shipment and the overflow is flumed to the waste-pond.

The material over ⅜ in. in size coming from this screen goes to a 30-in. Link-Belt inclined belt-conveyor which operates on 30-ft. centers and on which any clay present is picked out. The belt-conveyor discharges the gravel through a split chute to two sets of Dull conical screens consisting of four screens each. Additional wash-water is added from an 8-in. pipe at this chute. As is customary, these screens are paired as to sizes, the four screens in each set having 3-in. round, 1½-in. square, 1-in. square, and ⅜-in. round openings respectively. Rol-Man manganese wire screen-cloth is used on the second and third sets of screens. The others have perforated metal.

The fine material from the last screen and the water are flumed to waste. The three sizes of gravel are chuted direct to four timber bins which are set on ground-level and have a capacity of about 160 tons each. A 30-in. belt-conveyor, working on 180-ft. centers in a timber tunnel under the bins, is fed through Link-Belt clam-shell gates. This belt is horizontal under the bins and then inclines upward to a timber loading hopper which loads through a chute to cars on a siding. A perforated plate in the bottom of this chute and a spray directed on the plate give a final rinse to the gravel.

The plant has a capacity of 150 tons per hr. of highway stone or railroad ballast, which are its principal products. All shipments are made by rail. A ½-mi. siding connects with the Missouri Pacific Ry. and another ¼-mi. track with the Red River & Gulf Ry. Three steam locomotives are used for switching. New York Rubber Co. Stoneore conveyor belting is used at this plant.

A complete machine and blacksmith shop is equipped to make almost any necessary repairs. Work is also done here for the company's plant at Turkey Creek. The equipment includes a drill-press, power hack-saw, 18-in.-bed lathe, 24-in. by 8-ft. planer, bolt cutter, emery wheel, forge, air-hammer, etc. A Sullivan 8-in. by 8-in. air-compressor, belt-driven by a 25-hp. G. E. motor, furnishes air for the forge, hammer, etc. There is also a Smith Welding Mach. Corp. automatic acetylene generator.

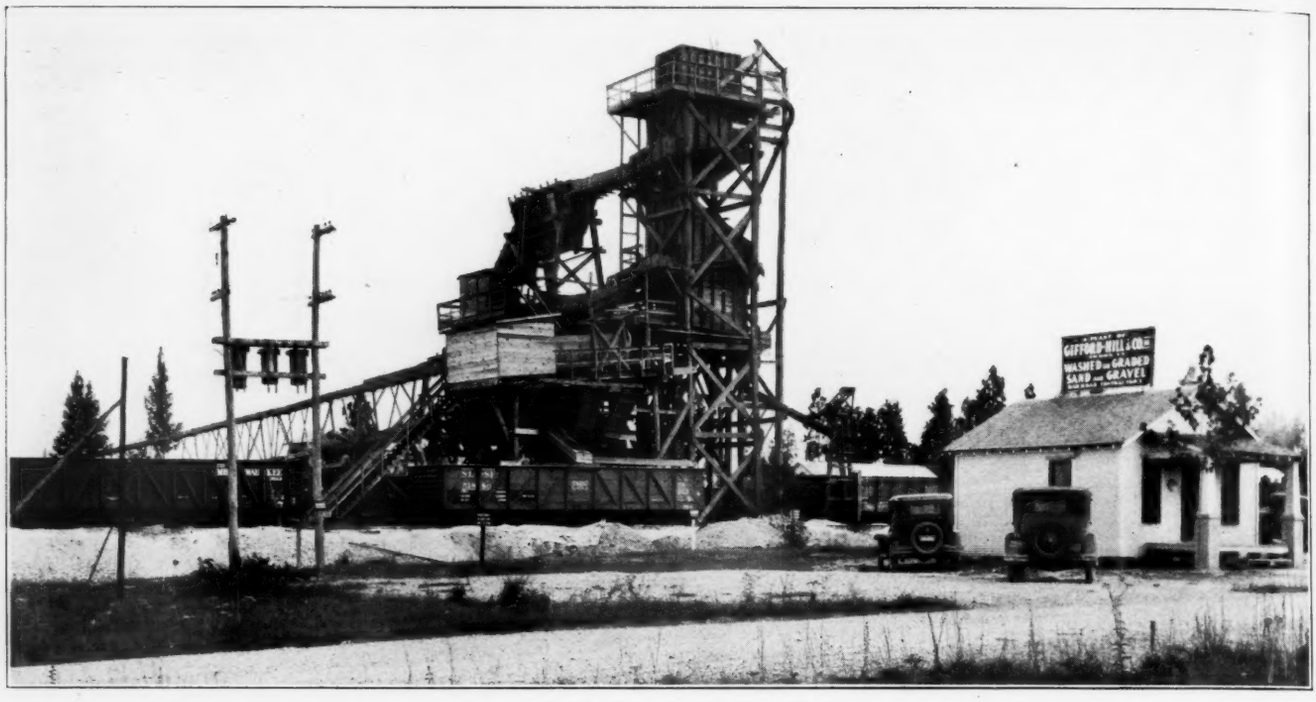
Turkey Creek Plant.—The deposit at Turkey Creek is 80 ft. deep and has a 10-ft. overburden which is removed by a Bucyrus Class 14 steam dragline handling a 2-cu.yd. Page bucket. The water level in the dredge-pond is about 20 ft. below the surface. The dredge has a steel hull and watertight compartments. The 10-in. Diamond dredging pump is driven by a 4-cyl., 240-hp. Fairbanks-Morse Diesel engine. The 300-ft. pipe-line discharges to a timber sump which is at the plant and from which the water overflows back to the dredge-pond. An 8-in. Amsco "booster" pump, driven by a 120-hp. 2-cylinder Fairbanks-Morse Diesel engine through a clutch and belt, rehandles the material from the sump to the top of the plant against a head of about 60 ft. This motor also drives the intake hoist and a small air-compressor used for priming the pump and starting the motor.

A rubber-lined timber box breaks the force of the flow and feeds through a spit chute over two sets of gravity screens which remove the sand and dewater the gravel. The sand goes to a wooden settling tank from which it can pass direct into cars or to a stock-pile. A 1-cu.yd. Sauerman Crescent scraper, operated by a steam hoist, rehandles the stock-piled sand.

The gravel retained on the stationary screens goes to a 30-in. Link-Belt belt-conveyor which is set on 20-ft. centers and is used as a picking belt to remove clay balls. This belt discharges to a 5-ft. by 24-ft. Telsmith revolving sizing screen provided with two outer jackets and a scrubber section. The screen cloth, which has 2½-in., 1-in., ⅝-in., and ⅜-in. square openings, is of Rol-Man manganese. The screen is driven by a 4-cyl. 20-hp. LeRoi gasoline engine. The various sizes of gravel are loaded direct to cars through three separate chutes.

Wash-water for the plant is furnished by a 6-in. Dayton-Dowd pump driven by a 65-hp. 6-cyl. Waukesha gasoline engine in a small floating pump-house anchored near the shore end of the dredge-line. A 2½-in. spur track connects with the C. R. I. & P. Ry., over which shipments are made. All switching is done by a steam locomotive owned by the company. There is a blacksmith shop where minor repairs are made and a plant office. A G. E. generator, driven by a 50-hp. Chicago Pneumatic Diesel engine, furnishes lighting current for the dredge and plant.

Most of the material produced at this plant is used for black-top roads. The plant's capacity is about 70 tons per hr.



The Searcy plant, with office building at the right.

Searcy Plant.—The deposit at Searcy, La., which is near Trout, was prospected before the plant was built and showed enough gravel to supply the plant for many years to come. The material contains from 50 to 65 per cent. gravel, very little of which is over 3 in. in size. The deposit ranges in depth from 30 to 54 ft. The overburden is from 2 to 10 ft. in thickness and is removed by a 1½-ton Monigan drag-line handling a 1½-cu.yd. bucket. This overcasts the overburden into the worked-out section of the pit.

The gravel is excavated by a Monighan walking drag-line which has a 120-hp. Fairbanks-Morse Diesel engine and operates a 3-cu.yd. Page bucket. It loads 4-cu.yd. Western side-dump cars which are hauled to the plant in trains of 6 to 8 cars each by one of three 12-ton Plymouth gasoline locomotives. The haul at present is about 1,500 ft.

At the plant the cars discharge to a timber sump from which the material is pumped by a 10-in. Diamond pump to the top of the plant. The pump is driven by a 200-hp. motor through Dayton Cog

Walking drag-line loading cars at Searcy pit. Drag-line in background is stripping, overcasting the overburden to a worked-out section of the pit.

Belt and operates against a head of about 70 ft. To assist in breaking up the clay, a spray hits the material as it is dumped from the cars. The pump-line discharges to a spread table which feeds a series of five gravity screens provided with ¼-in. openings. These screens are sprayed to insure the efficient removal of the fines, which pass over another spread table to three Link-Belt sand-cones. The fine and coarse sands produced are loaded directly into cars for shipment.

The material over ¼ in. in size coming from the stationary screens is chuted to a 60-in. by 24-ft. Telsmith rotary screen which also is equipped with sprays. This produces two sizes of gravel which are loaded direct to cars.

The plant has a capacity of about 150 tons per hr.

Miscellaneous.—The Forest Hill plant, incidentally, has made a name for itself in a field entirely separate from that of sand-and-gravel production. The employees at this plant have a basket-ball team which has made an enviable record in amateur circles in the state. Last year the team played some of the best traveling teams in the country and many of the colleges in Louisiana and won 40 out of 46 games. In the spring of 1932 the team followed this remarkable record by placing as runner-up to the winner in the Southern A. A. U. tournament.

The main office of Gifford-Hill & Co., Inc., is at 412 Mercantile Bldg., Dallas, Tex. The company's officers are: P. W. Gifford, president; J. R. Hill, vice-president; H. Whyte, secretary; H. M. Lacy, treasurer; and Jerry Higgs, chief engineer. L. E. Reel is general superintendent of the Louisiana plants and makes his headquarters at Forest Hill. The superintendents of the three Louisiana plants are: W. E. Shull, Forest Hill; Emory Grayson, Turkey Creek; and Howard Wilson, Searcy.

Mr. Reel, as general superintendent of the three Louisiana plants, is called upon to do considerable traveling between them, the company's main office at Dallas and many other points in Louisiana. He does much of this traveling in an aëroplane and has hangars and landing fields at both Forest Hill and Searcy. He uses a Travel-Air Series 4000 plane powered by a 220-hp. Wright Whirlwind motor. Mr. Reel was an observer in the United States air forces during the war and the experience acquired there has since saved him many hours of tedious travel.

Helpful Hints Regarding Efficient Operation of Excavators

There are several factors affecting the operating cycle of a shovel, according to D. B. Patterson, vice-president, Harnischfeger Corp., Milwaukee, Wis. The cycle can be divided into four consecutive actions:

1. Loading the dipper.
2. Swinging over the hauling unit.
3. Dumping the spoil.
4. Swinging back into the digging position.

Moving forward may be classed as a necessary interruption.

In ordinary excavation, four or more feet in depth, a 1-cu.yd. shovel should make at least two complete cycles per minute—provided hauling devices, such as trucks, are so placed that the average swing does not exceed 90 deg. (a quarter swing).

The respective time allowances per cycle are: Filling the dipper, 12 sec.; swinging to and spotting over truck, 9 sec.; dumping, 2 sec.; returning to digging position, 7 sec. The following hints may help one maintain this schedule:

Filling Dipper—Keep the dipper teeth sharp. Move forward frequently. Clean up the floor, permitting the material being dug to slide down into a loose heap.

Swinging and Spotting—Hoist while swinging. Keep hauling equipment close to cut, thus avoiding a long swing. The difference in swinging 90 deg. compared with 180 deg. may cut the output 25 per cent. Do not swing too fast when approaching the wagon or truck.

Dumping Spoil—When the dipper is nearing tripping position take up the slack in the trip rope. Start swinging back into loading position as soon as the trip is released.

Swinging Back to Dig—Start lowering dipper and reverse the crowd, being ready to crowd forward when the dipper strikes the ground.

A fast operator is not the only essential for fast loading. He can only dig what the equipment can haul. If the wagons or trucks are inadequate, or if they are poorly managed, maximum output can not be expected.

When starting a cut with a drag-line, begin close to the machine. By so doing much time can be saved over the method of casting the bucket to the maximum distance at the very beginning. Move the dirt which lies close to the machine first. The more distant dirt will have a tendency to follow into the cut. When the bucket is full, hoist out and get rid of it. Much time and considerable power is wasted when the bucket is pulled along after it is full of material.

When the dirt is kept cleaned away from the front of the machine, the cable does not bury itself when the bucket is hauled in. This not only lengthens the life of the cable, but also enables the operator to cut a smoother, more accurate slope. Furthermore, greater depth can be attained close up to the machine.

Hoist and drag cables should be kept tight. When the bucket is cast with the drag cable slack, it may land upside down, backward, side way or most any other way. This practice not only causes kinking and breaking of the cable, but also results in lost time.

When the hoist cable is kept taut the bucket can be hoisted the moment it is full. If slack is permitted in the drag cable while the bucket is being hoisted, much of the load spills out.

Cement Makers More Cheerful as Prices Remain Firm at Higher Levels

Profits Seen as Certain Next Year If Operators Keep Production Costs Down

IMPORTANT producers of Portland cement are not sanguine that the recent increase in price will have any material effect on their earnings this year. It is their opinion, however, that the advance makes it possible for the lower cost producers to look forward to fair earnings in 1933 with a continuance of the current rate of business, according to the *Wall Street Journal.*

Indications are that demand is firming up and that 1932 will mark the low point of consumption. Contracts are being let by the various states with greater frequency under the federal-aid act, while further stimulus to construction is probable as a result of the activities of the Reconstruction Finance Corp.

In meeting conditions of the last several years the larger producers have made great progress in reducing operating expenses and improving efficiency, the *Journal* continues. The result is that they are in a position to profit substantially by any stepping up in consumption. One important manufacturer states that some of the operating economies effected seemed almost impossible a few years ago, citing as an instance that his company is now producing a barrel of cement with 25 per cent. less fuel than two years ago.

The price advance of early August, the first since 1929, of from 19 c. to 29 c. a bbl. in the eastern territory (exclusive of metropolitan New York), and 30 c. a bbl. in the Middle West found dealers with the greater part of their 1932 requirements already booked with the manufacturers for future delivery at the lower price. Also, many took advantage of the interval between the time the price advance was decided on and the date it went into effect—a matter of some five days—to build up their stocks.

While the cement industry does not look for any further immediate advance in prices, it believes present quotations are showing increasing signs of greater stability and that the chaotic conditions that existed up to the middle of this year have been remedied, according to the *Wall Street Journal* observer. As the result of two years of declining demand and keen competition, marked by price slashing and the granting of secret concessions, the most severe price war in recent years developed during the closing months of 1930. In the first five months of 1931 five price cuts were made, bringing quotations to the lowest point in some 15 years. In New York, N. Y., cement, packed in paper containers and less all discounts, declined 40 c. a bbl. to $1.54 a bbl., while the Chicago quotation dropped by 46 c. to $1.40 a bbl. and the Albany price by 50 c. to $1.58 a bbl.

It is unlikely that any consideration will be given at this time to the matter of bringing the metropolitan New York price in line with the rest of the Eastern territory. In this district competition is still most severe, due primarily to foreign imports. Europe, with its cheap labor, depreciated currencies, and extremely low ocean freight rates (the product often is carried as ballast) is able to lay down cement in this port at a price that precludes any profit to the domestic competitor.

While small in the aggregate as compared with total American consumption, foreign imports have a demoralizing effect on the coast and immediate adjacent markets. Due to the obstacle of railroad freight rates, this foreign product is restricted to cartage distance of the port of landing with the result that it displaces the domestic output, which is consequently backed up on other markets already well served.

During the first six months of 1932 imports of foreign cement have aggregated 206,832 bbl., as compared with 292,608 bbl. in the corresponding period a year ago. In the full year 1931 a total of 457,238 bbl. were imported.

Current indications are that the American mills, with an annual capacity of 260,000,000 bbl., during 1932 will make between 70,000,000 and 75,000,000 bbl., as compared with 124,570,000 bbl. last year and the record of 176,298,846 bbl. in 1928, the latter figure representing 72.2 per cent. of capacity. Up to the close of July output this year totaled 41,815,000 bbl. in contrast with 74,032,000 bbl. in the corresponding period of last year.

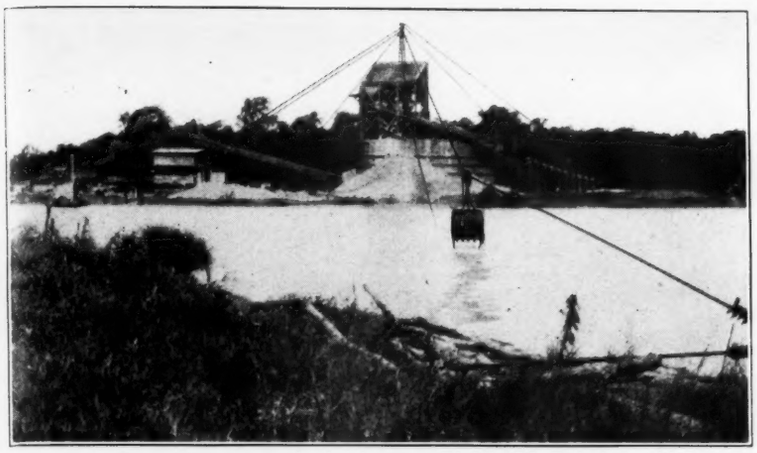
During July the ratio of the country's production to capacity, according to the U. S. Bureau of Mines of the Department of Commerce, amounted to 33.4 per cent., while the ratio for the 12 months ended with July totaled 34.2 per cent. A year ago these respective ratios were 62 per cent. and 53.8 per cent.

All of the major cement producers will undoubtedly report deficits as the result of 1932 operations.

Universal-Atlas Portland Cement Co., a subsidiary of the United States Steel Corp. and the largest potential producer in the industry, does not make public its financial reports, but it is likely its loss will be substantial.

For the 12 months ended June 30, last, Alpha Portland Cement Co. showed a net loss, after depreciation and depletion, of $1,193,449, as compared with a net income of $546,583, equivalent after preferred dividends, to 57 c. a share on the 711,000 no par shares of common stock outstanding in the preceding 12 months. There are outstanding 20,000 shares of 7 per cent. preferred shares, par $100.

(Continued on page 42)



The plant and cableway seen from the opposite side of the river.

Sand and Gravel Taken from Guadalupe River by 700-Foot Cableway

THE bed of Guadalupe River near Victoria in southern Texas forms one of the main sources of supply for aggregates in that part of the state. A number of plants operating near Victoria supply aggregates and ballast for a large territory. The newest of these is that of the Victoria Materials & Gravel Co., which is located 1 mi. west of Victoria. This company was incorporated under the laws of Texas in April, 1931. Construction was begun in that month and the plant was in operation on June 1, 1931. It has a capacity of 25 to 30 cars of gravel in a 20-hr. day.

The company has 1,000 acres of deposit with an average of 5 ft. of black soil overburden. The gravel extends to a depth of 95 ft., of which all except 5 ft. is below water-level. About 35 per cent. of this material is sand and less than 7 per cent. is over 2½ in. in size. The overburden is not removed but is caved in with the gravel. The gravel is pure hard flint and the sand is sharp and clean.

The material is excavated with a Sauerman 2-cu.yd. cableway excavator operating on a 700-ft. span. The cableway is suspended from a 90-ft. steel mast at the plant end. It has a 2-in. track cable and a ⅞-in. pull cable and is operated by a Sauerman 2-drum hoist driven by a 2-speed, 125-hp. Lincoln motor.

The bucket discharges over a sloping-rail grizzly at the top of the plant to a 50-cu.yd. hopper, which feeds a Link-Belt 60-in. by 10-ft. rotary scrubber. This discharges to a series of 4 Link-Belt Dull conical screens which have 2½-in., 1½-in., ¾-in. and ¼-in. perforations respectively and produce 3 sizes of gravel, oversize, and sand. The gravel is discharged directly to bins, the oversize is chuted to a small bin which supplies an 8-in. by 12-in. Universal jaw crusher, and the crushed gravel goes to an 8-in. Chain-Belt chain-bucket-elevator which operates on 58-ft. centers and feeds back to the scrubber and screens previously described.

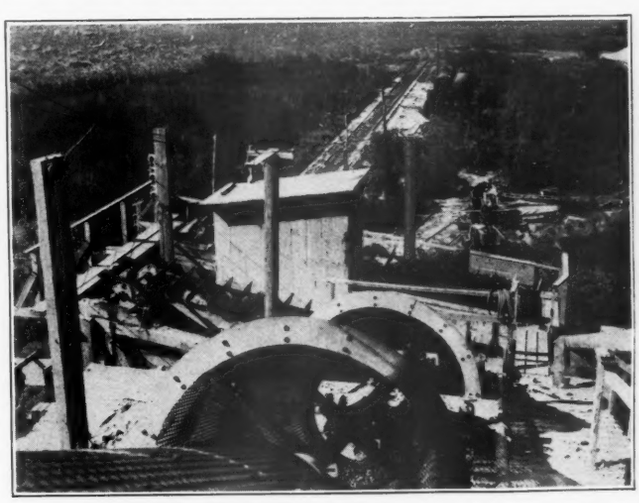
The fine material passing through the last screen goes to two 4-ft. by 20-ft. Link-Belt sand-drags arranged in series. One produces concrete sand and the other plaster sand; both discharge directly to bins. The water and silt overflowing from the sand-drags goes through a flume to a waste-pond.

The scrubber and the 4 sizing screens are on one drive-shaft and are driven by a 25-hp. motor through a Link-Belt silent chain and gear drive. The sand-drags are belt- and gear-driven by a single 10-hp. motor and the elevator by a 5-hp. motor through chain and a Chain-Belt speed-reducer.

The 8-compartment bin supporting the screening plant has a total capacity of 800 tons. One compartment is used for oversize, two compartments are used for sand and the other five for the three sizes of gravel produced. The bins feed, through side-discharge gates, a 24-in. belt-conveyor which operates on 220-ft. centers and leads to the loading building. Here the materials can be handled in any one of four different ways. When loading direct to cars the gravel is rinsed over a perforated-plate chute, or it can be discharged to a truck-loading bin which bin has a capacity of 50 cu.yd. of gravel and 25 cu.yd. of sand. Trucks are loaded by two Blaw-Knox volume batchers.

A short 24-in. belt-conveyor, alongside the storage-bins and above the loading conveyor, can feed from either the 1½-in. or the 2½-in. gravel bin, or from both bins, through a chute to the crusher, which is then set at ¾-in.

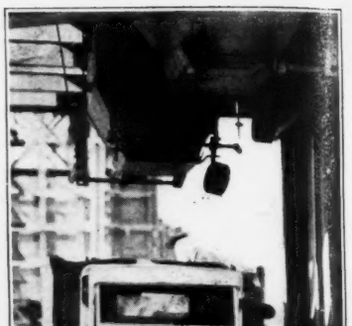
An 80-ton 6-wheel steam locomotive is used for switching and "spotting" cars and for hauling them over the 1-mi. switch track to the Southern



The sizing screens and sand-drags. A cotton field and pickers may be seen in the background.

Main building as seen from loading structure.

Left to right: Pres. George E. Cole, Supt. W. B. Glover, and Ralph Cole, bookkeeper.



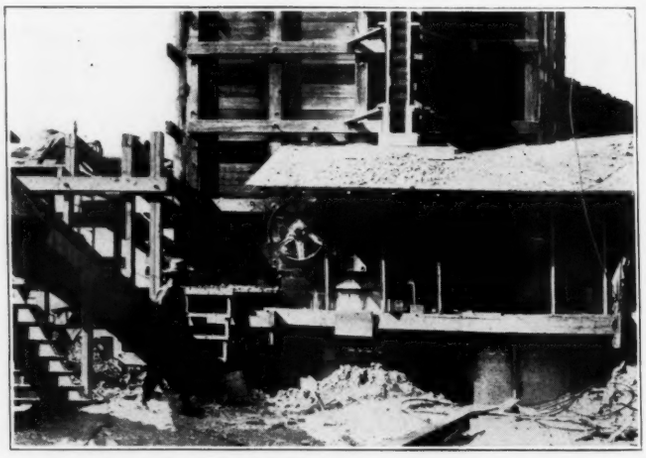
Truck loading at bins. Note the volume batchers.

Pacific Ry. An 8-in. by 6-in. Union centrifugal pump in a small house alongside the pond furnishes wash-water for the plant. It is direct-driven by a 30-hp. motor and handles 1,000 gal. per min. An artesian well, 407 ft. deep and near the plant, furnishes 300 gal. of water per min. for drinking purposes and for the locomotive. Electricity is received from a 22,000-v. line and reduced to 440 v. for all plant motors. Crouse-Hinds conduit and floodlights and General Electric motors and electrical equipment are used. All screens, gates and conveyors were furnished by the Link-Belt Co. American Cable Co. Trulay cable is used on the cableway.

The plant is at present serving a comparatively small territory but is later expected to supply many points along the Gulf Coast which are accessible by water. These include Houston, Beaumont, Port Arthur, Galveston, Corpus Christi and other points. The Intracoastal Canal from New Orleans to Corpus Christi is scheduled for completion some time this year and Guadalupe River is being deepened for a distance of 20 mi. from Victoria to the canal. As the company's property extends to the west bank of the river, it will then be possible to ship economically by water to all the above-mentioned points.

Gates feeding from bins to loading conveyor. Short conveyor above returns large stone to the crusher.

The main office of the company is at the plant. The company's officers are: Geo. E. Cole, president and general manager; O. L. Neyland, vice-president; and C. C. Carsner, secretary and treasurer. W. B. Glover is plant superintendent. Mr. Cole is a well-known engineer and contractor. Previous to his entry into the sand-and-gravel industry he designed and built the 1,260-ft.-long highway suspension bridge spanning Royal Gorge, 14 mi. west of Canon City, Colo. This was completed in 1929. Mr. Cole also designed and built the 1,550-ft.-long inclined railway which was completed at this location late in 1930.



The "oversize" crusher and the return elevator.

Organized Selling Cuts Costs for Indian Cement Industry

The use of cement in India is expanding to such an extent that the output of Indian plants in 1930 increased to 635,000 tons from 631,000 tons the preceding year, and has kept up to about that figure since then, in spite of generally depressed conditions. An association of eight of the ten manufacturing companies last year in a single selling organization has resulted in a decided drop in the cost and the selling price of cement.

Skyscrapers and Sidewalks of New York Built With Long Island Gravel*

North Shore Important Source for Nearly 50 Years; Dredging Operations Described

By ANDERSON DANA
Vice-President, Seaboard Sand and Gravel Corp.

SAND and gravel have been obtained from the north shore of Long Island for the past 40 or 50 yr., mainly for use in the building development of New York City. Originally small sailing vessels were employed in the trade. These were loaded by one-horse dump carts backed against the string piece of the sand-bank dock. Where their destination was a dock, the vessels were unloaded by wheelbarrows. In many cases, however, where no dock was available, they were beached, and the cargo was shoveled into carts driven into the water alongside. It was during this early period that the general name "Cow Bay sand" was given to sand coming from Long Island, as Manhasset Bay, also known as Cow Bay, was the source of most of the material. Nowadays, only a small portion of the brown sand coming into the metropolitan district actually comes from Cow Bay. Ninety per cent. of it is from property facing Hempstead Harbor, but it is still called "Cow Bay sand." Hempstead Harbor and Manhasset Bay form the two sides of Manhasset Neck, so that both properties are parts of the same general deposit.

The beginnings of the industry were all land operations, carried on by horse and cart, and later by steam shovel and narrow-gage railway. Mechanical screening plants with washing facilities for the preparation of the product were gradually introduced, as construction engineers became more exacting in their specifications.

In the early part of the twentieth century the demand for materials led to the opening of deposits farther from New York City, and an operation was commenced at Eaton's Neck, about 15 mi. to the east. This operation was an innovation for the industry in this part of the country. It consisted of a ladder dredge which rested on skids on the bank of a canal which ran through the beach. The ladder, with its continuous string of digging buckets, was lowered into the canal and brought up the material which was delivered to screens. The finished material in various sizes was wheeled to storage-piles by barrow. When enough of any given size of material was accumulated, a scow was brought alongside the bank of the canal and the material wheeled on board over gangplanks. When the ladder had dug as deep as was practicable in any one place, the whole rig was skidded along the bank a few feet and work begun anew. It can readily be seen from this description how primitive this operation was, and about 1911 it was abandoned. A screening plant was erected on the southern point of Eaton's Neck and a bucket dredge installed to do the digging. Sand and gravel were first dug from the canal where the earlier operation had been carried on. The material was loaded on scows and brought to the screening plant, where after treatment it was reloaded on scows for the market.

About 1915 sand-and-gravel mining moved still farther east. A ladder dredge was put to work just outside the entrance to Port Jefferson Harbor. This operation, however, was short lived, as the dredge was wrecked in a storm after working only a few months. Nothing more was done in this district until early in 1919, when a bucket dredge went to work in the harbor itself. This dredge burned in the fall of the same year. Both these dredges were self-contained units with screening plants for preparing the product on board. In the latter part of 1919 a self-contained suction dredge started work in Port Jefferson Harbor and the same company is still operating there with a newer and larger dredge of the same type, loading finished material directly on scows alongside.

In 1923 our company began producing material in Port Jefferson, using a suction dredge in conjunction with a crushing-and-screening plant on shore to which the material was pumped through a pipe line.

Geology.—The surficial deposits of Long Island are of glacial origin. They are composed almost entirely of sand and gravel, particularly along the north shore, but there are occasional beds of clay and bowlders. The clay varies in quantity and occurs at almost any depth in the deposits. The bowlders, however, are more systematic in their occurrence. In every case in the writer's experience they are found at the surface, or within 8 or 10 ft. of it. The overburden on Long Island consists of top soil, which never exceeds a depth of 2 ft. and is not more than 4 or 5 in. thick on the property now being worked. Here the sand and gravel occur in well-defined strata, which vary in thickness from a few inches to several feet. These strata are more clearly defined near the surface where the gravel content is much heavier than deeper in the bed. With

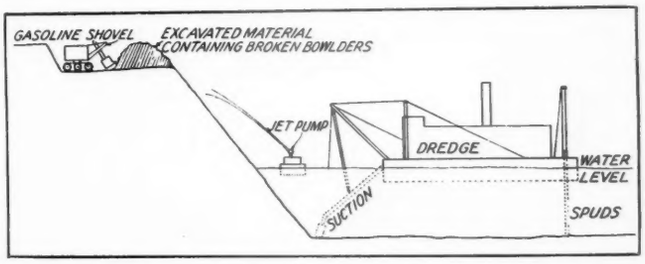


Fig. 1. Sectional sketch of dredge and gravel bank, showing method of operation.

* Reprinted from U. S. Bureau of Mines Information Circular 6,592.

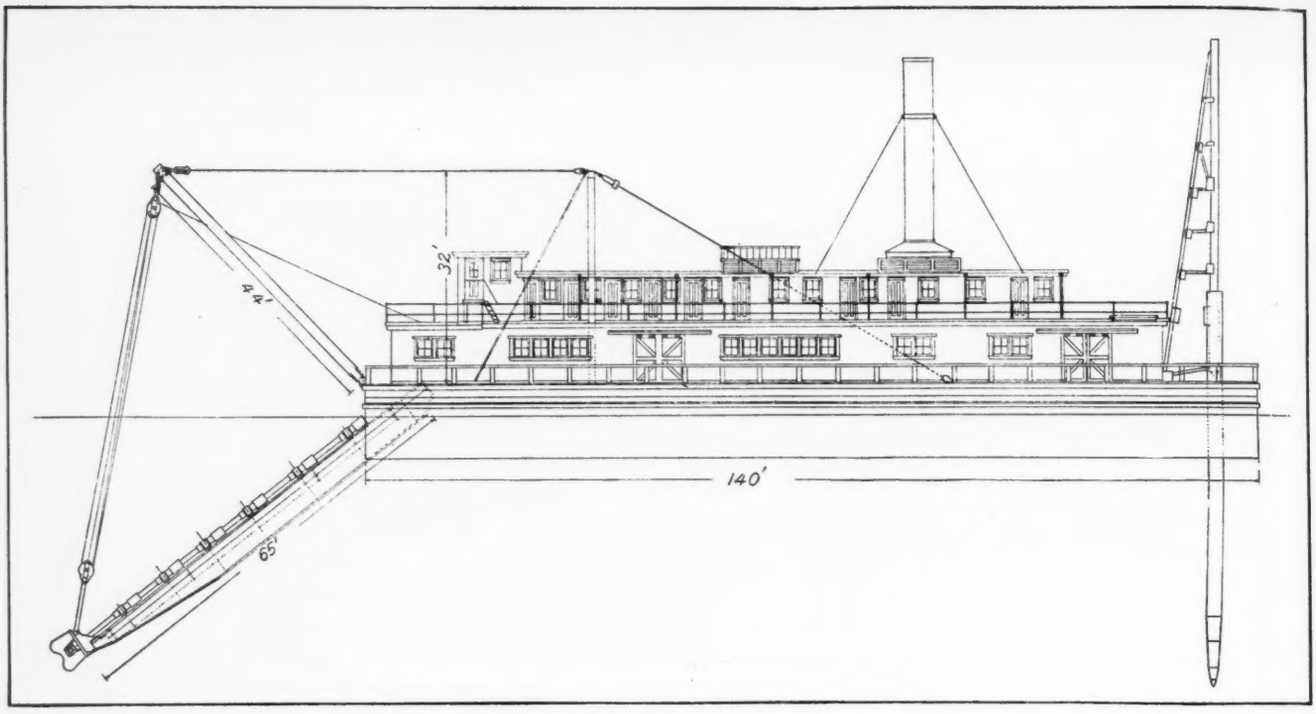


Fig. 2. Side view of the dredge.

depth the layers disappear and the material seems to be largely sand with occasional pebbles in it. No clay has been encountered in the bank now being worked.

Development.—Before commencing operations, two methods of handling the material were considered. The first method comprised mining with a steam shovel, and delivering the material to the screening-and-washing plant by trucks or cars. The second method was mining with a hydraulic dredge. In this case the dredge could start in the harbor, dredge its way into the property digging to a determined maximum depth and pumping the material to the screening plant. All the arguments were in favor of the dredging operation. It was not only cheaper than mining by steam shovel, but the recovery from a given acreage was much greater, as a shovel could not operate below high-water mark, while a dredge could easily reclaim an additional 40 ft. in depth.

Characteristics of Material.—The chemical analysis of Port Jefferson sand is as follows:

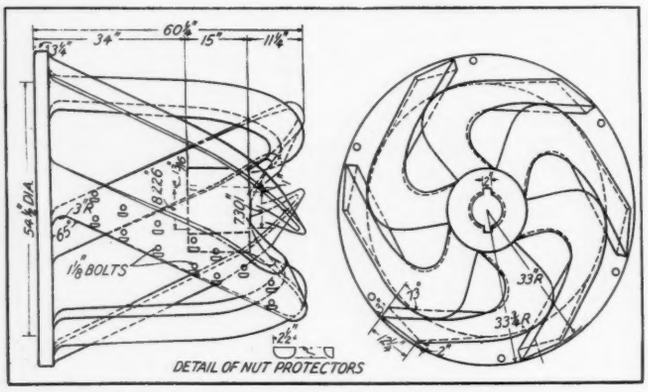


Fig. 3. Side and end views of cutter-head.

	Per Cent.
SiO_2	95.98
Fe_2O_3	2.37
Al_2O_3	0.83
CaO	0.29
MgO	0.03
SO_3	0.01
Cl	0.03
Loss on ignition	0.46

The gravel is practically pure quartz with a small percentage of calcareous conglomerate.

The topography of the deposit rendered test borings unnecessary, as the promontory, of which the property forms the larger part, has three sides exposed and clearly shows the strata of sand and gravel from the surface to water-level. Test pits were dug in various places in the banks to confirm the fact that the original formation was exposed and not merely covered by slides. These pits were scarcely more than burrows, which a man with a shovel could dig in an hour, so that their cost was negligible. A rough survey of the property gave elevations from which it was simple to calculate the amount of material reclaimable. This was done by multiplying the area by the average elevation, plus the depth below high water to which it was thought feasible to dredge. No allowance was made for the slight overburden or for the swell in finished material over material in place. Experiment determined that a cubic yard of screened sand weighed 2,450 lb. and a cubic yard of gravel 2,550 lb. loose measure.

Mining Method.—Having determined on a suction dredge as the means of mining the material, the question of the preparation of the sand and gravel remained to be decided. Owing to the many specifications which must be met in the metropolitan market, calling for at least a dozen different sizes and mixtures, it was evident that all the necessary

screening could not be done on the dredge itself. The dredge, also, could not provide storage except for materials that were being immediately loaded on scows. These two factors led the company to build on shore a screening-and-storage plant to which the dredge would pump the material. A shore plant also provided facilities for crushing oversize gravel and small bowlders into commercially salable material. Fig. 1 is a sketch of the dredge and gravel bank, showing the method of operation.

The 20-in. suction dredge *Whirlwind,* which is shown in side view in Fig. 2, and about 40 wooden pontoons were purchased for the work. The dredge has a wooden hull 140 ft. long, 38 ft. wide, and 11 ft. deep. The pontoons are rectangular wooden floats 6 by 12 ft., with 4-ft. sides. They carry the pontoon pipe in a cradle on deck with the pipe running athwartship. When it becomes necessary to acquire more pontoons, the wooden type will be abandoned for those of cylindrical steel construction.

The *Whirlwind's* pumping and power plant consisted of a 20-in. Morris centrifugal pump, driven at 190 r.p.m. by a 750-hp. triple-expansion, direct-connected Morris steam engine, powered by two 400-hp. Babcock and Wilcox stationary boilers, carrying 180 lb. of steam. There are 130 four-in. fire tubes 18 ft. long in each boiler. The auxiliary machinery consisted of a Mundy 5-drum, 8-in. by 12-in. hoisting engine to handle the suction and spud hoists, and the two swing lines. A 12-in. by 12-in. Lambert engine drove the suction cutter by a shaft running down the ladder and geared to the engine at the ladder trunnion. Side and end views of the cutter-head are shown in Fig. 3. In addition there was a 7-kw. generator, driven by an American Blower Co. engine, the necessary battery of feed pumps, and a C. H. Wheeler condenser.

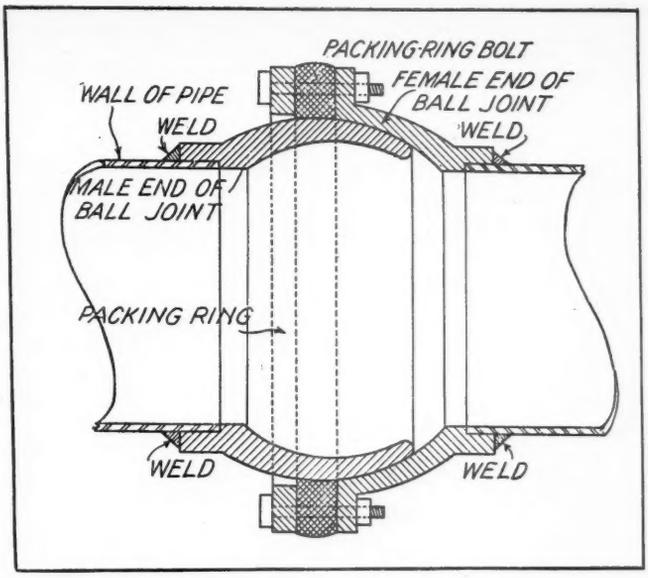


Fig. 4. Section of ball joint in pontoon pipe-line.

Plant.—Material is transported from the dredge through a pipe-line of 40-ft. lengths connected by ball-and-socket joints (Fig. 4) to a spreading table (1 in Fig. 5) at the north end of the plant at an elevation of about 35 ft.

The spreading table is 28 ft. 9 in. long and 16 ft. 5 in. wide and is built of wood sheathed with ¼-in. steel plates. It slopes at an angle of 10 deg. toward the plant, and its purpose is to retard the water and spread out the material, as its name implies. A plow at the lower end of the table divides the material into two streams which flow into two 5-ft. by 16 ft. double-jacketed, Link-Belt revolving screens (2 in Fig. 5). The inner of these screens are manganese-steel plates with 1⅞-in. perforations. The intermediate jackets are woven from ¼-in. manganese-

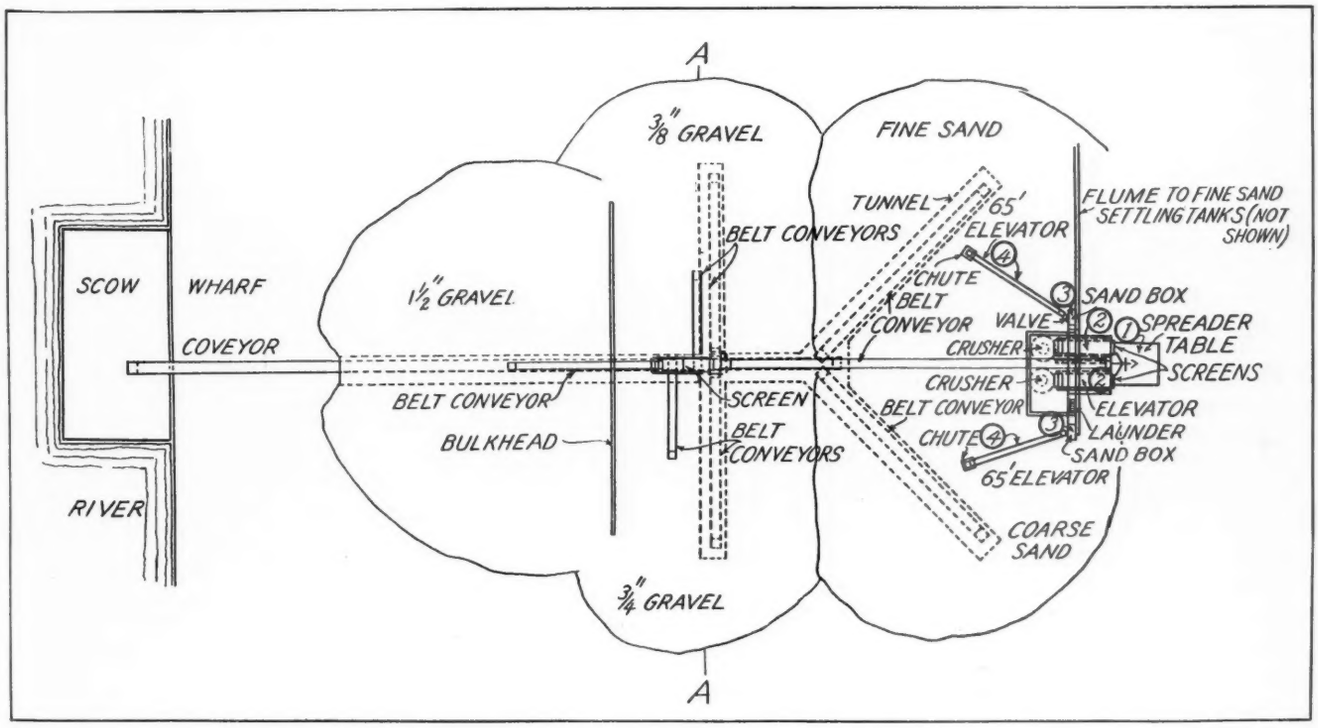


Fig. 5. Plan of the shore plant.

steel wire and have ½-in. square openings. The outer jackets are formed of oblong-mesh wire cloth with openings ⅛ in. by ⅝ in. The screens are set on a slope of 1½ in. to the foot and make 13 r.p.m. They are supported on trunnions and are belt-driven from a line-shaft operated by a 50-hp. motor. Each screen handles about 300 tons per hr.

Entering the screens, the pebbles which are too large for commercial use pass over the 1⅞-in. openings of the inner screens and out at the low ends, dropping through chutes to two No. 6-K Allis-Chalmers crushers which have 1¼-in. discharge openings. A bucket-elevator returns the material from the crusher pit to the spreading table, where it again has an opportunity of passing through the screens. This elevator is 40 ft. long between centers and has a 22-in., 12-ply belt with ⅛-in. and 1/16-in. rubber covers. Its buckets are 22 in. by 10 in. by 11 in., it travels 182 ft. per minute, and is belt-driven from the same line-shaft that operates the main screen. The commercial-size pebbles drop through the 1⅞-in. holes and the larger of them are carried on the intermediate jackets to chutes which lead to the fine sand is now reclaimed by a stiff-legged derrick handling a clam-shell bucket, and mixed with the coarser sand from the original tanks. The secondary settling tanks are elliptical and are 60 ft. long, 42 ft. wide, and 9 ft. deep.

To return now to the gravel conveyor belt. All sizes of merchantable gravel are deposited on the lower end of this belt. Rising at an angle of 18 deg., it conveys the material to an elevation of 40 ft., and delivers it to a 5-ft. by 20-ft., double-jacketed, Link-Belt revolving screen (3 in Fig. 6). The inner screen has 1¼-in. holes, the inner jacket has ⅞-in. holes, and the outer jacket has ⅜-in. holes. The screen is chain-driven at 14 r.p.m. by a 40-hp. motor which also operates the gravel-distributing belts. It has an inclination of 1½ in. to the foot and handles about 200 tons per hr. This screen separates the material into three commercial sizes of gravel: namely, 1½-in., ¾-in., and ⅜-in.

The 1½-in. gravel passes over all the openings in the screen to another conveyor belt (4 in Fig. 6), which delivers it to its storage-pile. This conveyor is 50 ft. between centers and has a 30-in., 6-ply belt,

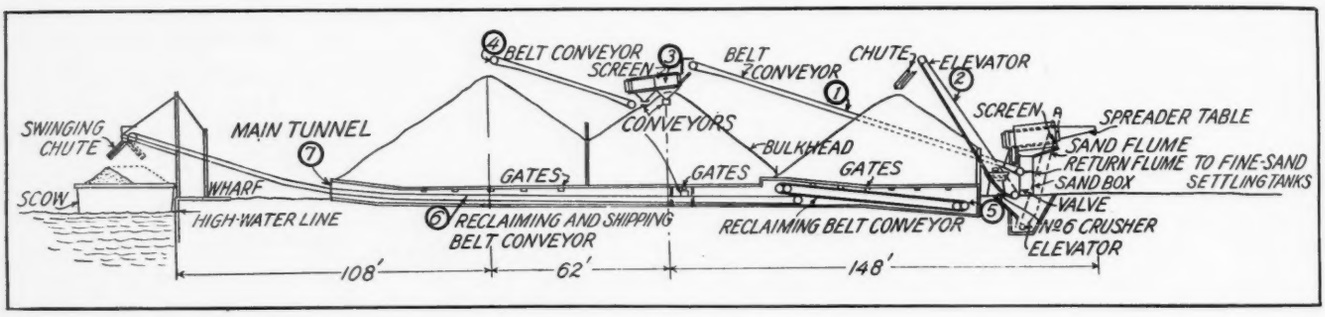


Fig. 6. Longitudinal section of the plant.

gravel conveyor belt (1 in Fig. 6). The smaller-sized pebbles and sand, with the water, drop through the intermediate jackets and on the outer jackets, which carry their oversize to the same chutes as the larger pebbles. The sand and water pass through the outer jackets into settling tanks (3 in Fig. 5) from which the coarse sand is reclaimed by belt- and-bucket-elevators (4 in Fig. 5) and deposited on the storage-piles. The sand elevators are 65 ft. between centers and have 36-in., 12-ply belts with ⅛-in. and 1/16-in. rubber covers. They carry 8 in. by 11 in. by 18 in. buckets, staggered on 12-in. centers, and travel 288 ft. per min. Each elevator is driven by a 60-hp. motor through a Morse silent-chain drive. The waste-water overflowing from these settling tanks is carried away by unlined wooden flumes to an unused part of the property, from which it finally finds its way back into the harbor.

Originally it was hoped that the proper quality of sand could be reclaimed from these settling tanks. It was soon found, however, due to the small size of the tanks (they are only 13 ft. 9 in. long, 10 ft. wide and 8 ft. deep), that there was too much agitation of the water for the fine sand to settle, and it became necessary to construct two secondary settling tanks of much larger capacity from which the with ⅛-in. to 1/16-in. rubber covers. It travels 425 ft. per min.

The smaller sizes of gravel from the finishing screen pass into hoppers, and are carried to their different storage-piles by two other belts (1 and 2 in Fig. 7). Both these belts are 32 ft. between centers and travel 425 ft. per min. They are 30 in. wide and 6-ply with ⅛-in. and 1/16-in. covers.

As may be seen from Fig. 5, the plant is roughly star-shaped, the two sand piles and the three gravel piles forming the five points of a star.

Under each storage-pile there is a tunnel containing gates in the roof and conveyor belts which carry the material to the main loading tunnel (7 in Fig. 6), and on the main loading belt (6 in Fig. 6), which runs out on the dock. The belts feeding the main conveyor belt are all 36 in. wide, 6-ply, with ⅛-in. and 1/16-in. covers. The east and west side sand belts are 75 and 130 ft. between centers, respectively, and travel 455 ft. per min. Between centers the ¾-in. and ⅜-in. gravel belts are 55 and 105 ft. long, respectively. The main loading conveyor is a 42-in., 8-ply belt with ⅛-in. and 1/16-in. rubber covers and travels 450 ft. per min. between 245-ft. centers. These conveyor belts last about 2 yr.

Recently it has been found necessary to make a fourth size of gravel, and a storage-pile for ½-in.

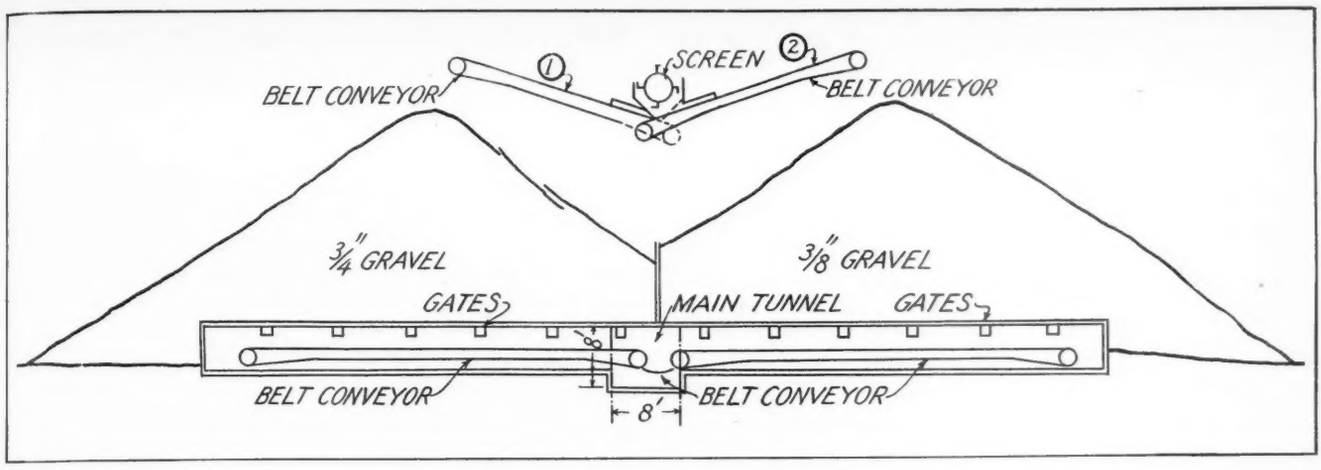


Fig. 7. Section through plant (AA in Fig. 5).

material has been added at the southwestern end of the plant. This size has been made by adding a third jacket to a section of the finishing screen. This addition is not shown in the illustrations.

Loading Finished Material.—One feature of the plant which may be of interest is the method of loading scows. The loading conveyor projects about 18 ft. beyond the line of fender piles against which the scows lie, and delivers the material into a movable steel chute which travels back and forth at right angles to the dock. This travel is sufficient to cover the entire width of a scow. The chute is operated by a 5-hp. motor, driving through a worm gear which holds the chute at any given angle when the motor is turned off. On the dock is a double-drum winch, which moves the scows along the side of the dock, enabling the chute to deliver to the entire length of their cargo compartments. One man, therefore, by manipulating the winch and the loading chute, can so load the scows that there is practically no trimming to be done after the full cargo is aboard. The loading dock and chute are shown in Fig. 6.

The trimming of a loaded boat is important, as sand and gravel in this district are sold by the cubic yard, and the only means of arriving at the contents of the scow is by measurement of the cargo, which must be trimmed to a regular shape.

With the exception of the dredge itself, the entire operation is completely electrified. Power is purchased from the Long Island Light & Power Co. and costs about 2½ c. per kw.-hr. All motors of more than 25 hp. operate at 2,200 v., and those of less power at 220 v.

When the dredge *Whirlwind* started she was equipped with a manganese-steel cutter (see Fig. 3). Trouble was constantly encountered during the first three years because bowlders jammed in the cutter blades, which necessitated raising the ladder and prying the bowlders loose. About three years ago, it was determined to try to operate with a straight suction and to do away with the cutter. A special suction head was constructed with crossed bars to prevent oversize bowlders from getting into the suction pipe and was also equipped with water jets to assist in loosening the material on the bottom. This suction head proved satisfactory and its use resulted in a saving of about 30 per cent. in steam consumption on the dredge.

Shortly after the operation started, and the dredge had begun to work her way into the bank, it was found that there were constantly recurring slides caused by the suction undermining the bank. Anywhere from 50 to 200 tons of material might suddenly slide down into the water. This was extremely dangerous, and several spuds were broken by the waves created by the slides. In order to overcome this, a small float was constructed and on it was placed a 1⅝-in. monitor nozzle attached to a 4-in., single-stage centrifugal pump driven by a direct-connected 100-hp. motor. This nozzle plays constantly upon the bank ahead of the dredge, washing it down to a safe angle, so that no slides are possible (see Fig. 1). The pump delivers 600 gal. per min. at 115 lb. pressure.

The steady stream of water against the bank has another beneficial effect. It uncovers all bowlders that may be in the bank, and by careful manipulation it is possible to ease them down to the water-level where they can be picked up and carried out of

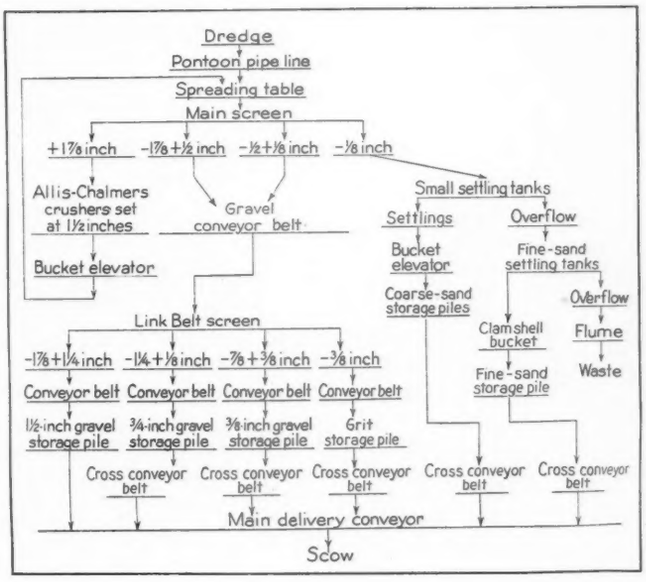


Fig. 8. Flow-sheet of the operation.

the path of the dredge, thus lessening the danger of stoppage at the suction head. Small bowlders are picked up by hand and the larger stones are removed by a small derrick on a scow, which carries them to an area that has been dredged and where they are thrown overboard.

Another advance in the battle against bowlders was made by the acquisition of a 1-cu.yd. crawler shovel. This operates on the top of the bank, digging to a depth of 10 or 12 ft. (see Fig. 1). The shovel merely turns the material over and, in handling it, the bowlders are uncovered. As soon as one is found, it is drilled and shot, or sledged down to a size that will pass in the pumps and pipe-line. This shovel operates for about eight months of the year.

After a few months of operation in 1923, it was found that the dredge did not have sufficient power to deliver the desired quantity of material to the spreading table in the plant. A "booster" pump, driven at 210 r.p.m. by a 350-hp. motor, was therefore installed on shore. This arrangement worked successfully for two years, or until the dredge had dug itself so far into the bank (about 700 ft.) that the distance between the dredge and "booster" became uneconomical.

The "booster" and its motor were thereupon installed upon a float and moved up to a position 400 or 500 ft. to the stern of the dredge, where the "booster" worked most efficiently. In 1930 the dredge had eaten its way so far into the bank that, even with the aid of the existing "booster," it did not have power enough to deliver the required quantity of material. A 650-hp. motor was, therefore, installed in place of the 350-hp. motor, and the speed of the "booster," now driven by a Texrope drive, was increased to 220 r.p.m. The distance from the dredge to the "booster" is kept at about 400 ft., as this distance has been found to be the most economical operating position. The distance from the "booster" to the shore varies from 300 to 1,200 ft., according to the position of the dredge.

The pipe-line through which the material is transported from the dredge to the screening plant is 20 in. inside diameter and is made up of 40-ft. lengths connected by ball- and-socket joints. The pressure in the line varies between 30 and 40 lb. per sq. in. This pressure frequently blew off the rubber sleeves which were originally used as joints, and necessitated the adoption of the ball joint which is illustrated in Fig. 4. Each 40-ft. length of pipe is carried by two pontoons.

After the pipe-line reaches shore it is carried up to the spreading table on a trestle. As no movement takes place in this part of the line, the lengths of pipe are flanged and permanently bolted together.

During the first few years of the operation, it was found necessary to have this pipe specially made by welding. This method was extremely expensive, as pipe with a ⅜-in. wall cost between $11 and $12 a ft. In the last five years, however, it has been possible to obtain wrought-steel pipe at approximately $6 a foot. Not only is the cost per foot less, but the wall of the pipe is ½-in. thick, so that it lasts considerably longer.

Fig. 8 shows a flow-sheet of the plant.

Transportation.—After the scows have been loaded at the plant, they are towed out to a stakeboat, maintained in the harbor of Port Jefferson, to await transportation to market. The shifting is done by a company-owned tug, the *Takana*, a wooden vessel 69½ ft. long, 18 ft. 7 in. in the beam, and drawing 8 ft. 8 in. The empty scows are moored to one side of the stakeboat, and the loaded scows to the opposite side. The majority of the company-owned scows are 118 ft. long, 37 ft. wide, and 10 ft. deep. Chartered scows vary from this size down to 112 by 32 ft. All scows take deck loads and their capacity varies from 600 to 1,000 tons.

Towing to the various markets which our company serves is done by contract. The principal market is in the New York metropolitan district. Scows for delivery in this district are towed down the sound in flotillas of 5 to 8. Arrived at a central point in New York Harbor, the tow is broken up and the scows distributed to various docks.

A considerable part of the company's output is marketed in towns along the northern shore of Long

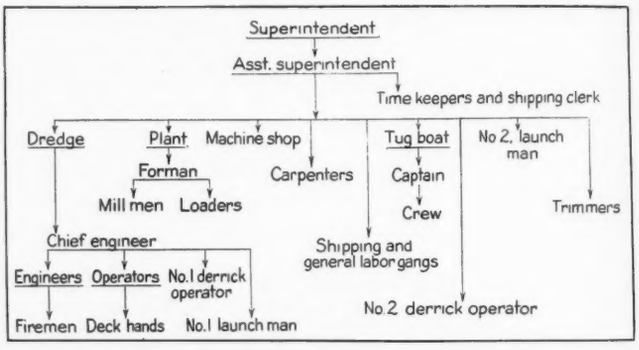


Fig. 9. The organization chart.

Island Sound. Delivery to these destinations is usually made in single scows, as there is seldom call for more than one scow-load at a time.

This company maintains no retail yards or any unloading facilities, the material invariably being sold f.o.b. scow alongside the dock at destination.

From the experience of more than eight years, it is safe to state that the deposit which the company is mining contains about 70 per cent. of sand and 30 per cent. of gravel. Of the total gravel mined the percentages of the different commercial sizes produced are as follows: 1½-in., 20 per cent.; ¾-in., 50 per cent.; ½-in., 15 per cent.; ⅜-in., 15 per cent.

The average life of the various screening surfaces is as follows: The fine, oblong-mesh wire on the outer jacket of the main screen handles 180,000 cu.yd., the manganese-steel wire cloth of the inner jacket carries 1,200,000 cu.yd., and the inner screen of manganese-steel plate carries 1,400,000 cu.yd. before they must be replaced.

On the finishing screen, which handles only 30 per cent. of the plant's total output, it has never been thought necessary to use manganese steel because ordinary steel plate handles 375,000 cu.yd. before replacement is necessary. For the same reason, ordinary steel-wire cloth is used on the outer

(*Continued on page 40*)

The Nonmetallic-Mineral Resources of UTAH

By R. A. HART
Industrial Secretary,
Salt Lake City Chamber of Commerce

UTAH is known best as a metal-mining state, and well she may be, inasmuch as she stands high among all the states of the nation in the production of the five chief nonferrous metals. In 1929 the total value of her production of gold, silver, copper, lead, and zinc was $96,485,000, which was one-seventh of the total for the whole country, and in that year Utah ranked first in silver, second in copper, third in lead, fourth in gold (including Alaska), and fifth in zinc.

The state also is known widely for her treasures of coal and iron, approximately one-sixth of her area being underlain with coal, the unmined reserve being close to 200,000,000,000 tons, while it is probable that the iron deposits contain at least 1,000,000,000 tons of ore, largely hematite averaging 57 per cent. iron.

In addition to the foregoing, this remarkable state possesses known commercial deposits of minerals representing more than two hundred varieties, many of them more or less unusual, some not found elsewhere in the United States and one, at least, not found elsewhere in the world. It has been claimed, without successful contradication, that Utah possesses a greater variety of natural resources than any other state in the Union and a greater variety of mineral resources than any comparable area on the face of the earth.

But, without depreciating the importance of her metallic deposits and her coal resources, it is the conclusion of those who have given the matter the most thought that Utah's ultimate development depends upon the exploitation and utilization of her nonmetallic-mineral resources, the number of varieties of which is astounding and the supplies of most of which are practically unlimited. For example, less than ten of the nonmetallics listed on page 502 of PIT AND QUARRY HANDBOOK AND DIRECTORY (1932) are not known to be available in Utah and probably less than half of that number actually are not available, while, on the other hand, scores of nonmetallics not so listed are obtainable.

It likely would serve no useful purpose to attempt to discuss each of the nonmetallic minerals found in Utah, or even to list the entire group, so for the purposes of this article, it is deemed expedient to consider, in some detail, those materials of chief interest to readers of PIT AND QUARRY and to supplement this with a discussion of some of the more unusual mineral resources with which Utah is blessed. Fig. 1 is a map of Utah, showing the principal deposits of nonmetallic minerals by counties and their approximate locations.

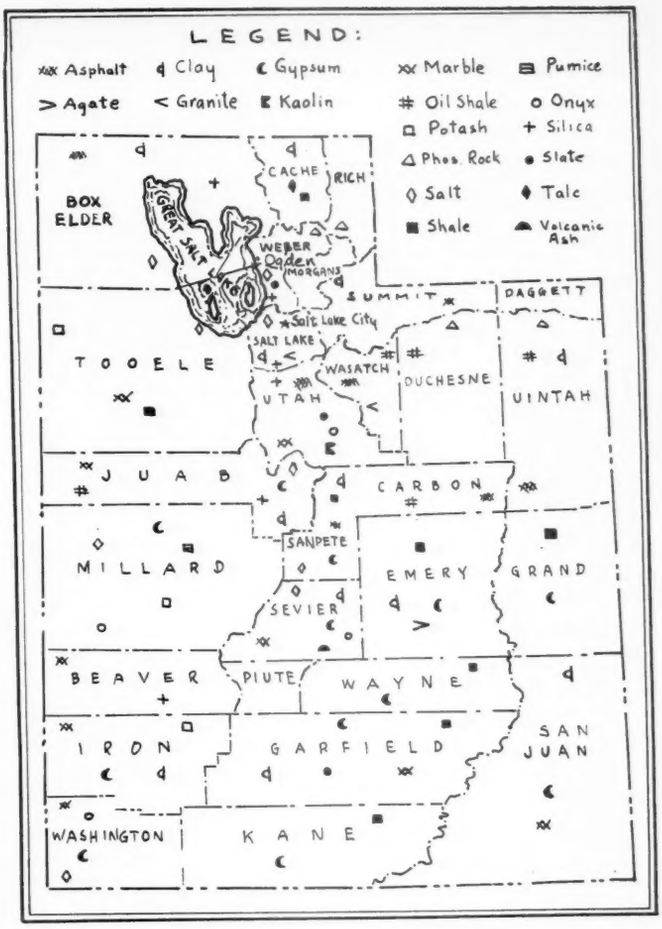


Fig. 1. Sketch map of Utah showing locations of some of the important deposits.

It will aid in the understanding of Utah's nonmetallic resources, briefly to describe the major geologic and topographic features of the state. The Wasatch Mountains and continuing ranges of mountains extend in a general southerly and southwesterly direction down the middle of the state from the northern boundary to a point not far from the southern boundary. These mountains rise to heights of approximately 13,000 ft. as a maximum.

The area west of the Wasatch Mountains and the continuing ranges is occupied by the Great Basin and represents the bed of pre-historic Lake Bonneville, a Pleistocene body of fresh water of the Quaternary Period, which was approximately the size of Lake Michigan and of which the Great Salt Lake is the major remnant, other remnants being Utah Lake, a fresh-water body, Sevier Lake, a saline body of water, and several small bodies of water. The somewhat level terrain of the Great Basin is broken by the Basin Ranges, a series of mountain chains extending more or less parallel to the Wasatch Range and alternating with valleys over the whole expanse lying between the Wasatch

Mountains and the Nevada line. The Great Salt Lake Desert occupies the largest and flattest of the intervening spaces but is itself broken by occasional mountain peaks protruding upward through the old lake bed. The southern rim of the Basin is only a few miles north of the Arizona line. From the rim of the Basin the terrain drops rapidly to the valley of Virgin River, an arm of Colorado River. The lowest altitude of the state, a little more than 2,000 ft., is in the valley of Virgin River, whereas the average elevation of the Great Basin is about a mile above sea-level and the very bottom of the Great Salt Lake is at an elevation of about 4,150 ft.

The major portion of the area lying east of the Wasatch Mountains is occupied by the Colorado Plateau, which is drained by Colorado River and its tributaries, particularly Green River, and which is broken by numerous uplifts, many of them of major importance. The northern portion of the above-mentioned area is occupied by the great Uinta Basin, which comprises about one-fifth of the area of the state.

North of the Uinta Basin and paralleling the Wyoming boundary, at no great distance from the latter, the magnificent Uinta Mountains raise their peaks to elevations in excess of 14,000 ft. This is the only east-west chain of mountains in North America.

All geologic ages are represented in the various structures in Utah and, in consequence, the available materials range from elementary igneous rocks to the most recent lacustrine sediments and alluvial deposits. The various materials are exposed at escarpments, in the bold mountain masses and in canyons through stream erosion.

As an example of the occurrence of a great variety of materials in close proximity to the points of use, attention is called to the section of the Wasatch Mountains adjoining Salt Lake City. At the south end of the section, in Little Cottonwood Canyon, the formation is granite. Advancing northward for a distance of 20 mi. succeeding canyons expose limestones, sandstones, calcareous tufa, gneiss, quartzite, conglomerates, shales and lacustrine deposits of sands and gravels, the former ranging in purity up to and including acceptable glass silica.

Sand and Gravel.—As has been indicated, the western third of the state formerly was occupied by Lake Bonneville. Three-fourths of the population of the state resides in the area formerly covered by the water of this old lake and creates the chief demand for sand and gravel. Streams entering the area over long geologic periods carried *débris* which was thrown down as the flowing water entered the lake, the heavier and coarser materials being deposited in delta formations near the mouths of the streams and the finer materials being carried out farther into the lake. Thus, sand in varying grades of fineness and gravel in all sizes from pea gravel up to cobbles are to be found at all canyon mouths, not to mention the occasional bowlders, often of enormous size, which have been transported at times of unusual stream discharge. The composition of the gravels varies, of course, with the nature of the formations in the various canyons. Much the same availability of sand and gravel obtains throughout the state as a result of stream action.

A number of the deltas above mentioned are enormous in size, and practically unlimited quantities of sand and gravel are to be had merely for their excavation, overburdens being inconsequential in most instances. Some of the larger deposits have been exploited by railway and other interests.

Notwithstanding the general occurrence of sand and gravel, several concerns have established important enterprises engaged in the grading and washing of sand and gravel for various purposes. A typical pit and plant are illustrated in Fig. 2. This lay-out is located within the city limits of Salt Lake City.

The state's known annual output of sand and gravel is in excess of 1,000,000 tons having an approximate value of $275,000.

Crushed Stone.—Coincident with the marked development of highway construction, during the past decade there has been a greatly enlarged utilization of crushed stone, not only for concrete fabrication but for the surfacing of secondary roads. Like sand and gravel, rock suitable for crushing is found within easy reach in all portions of the state, the materials including igneous rocks, granite, gneiss, trap rock, limestone, quartzite and other natural stones.

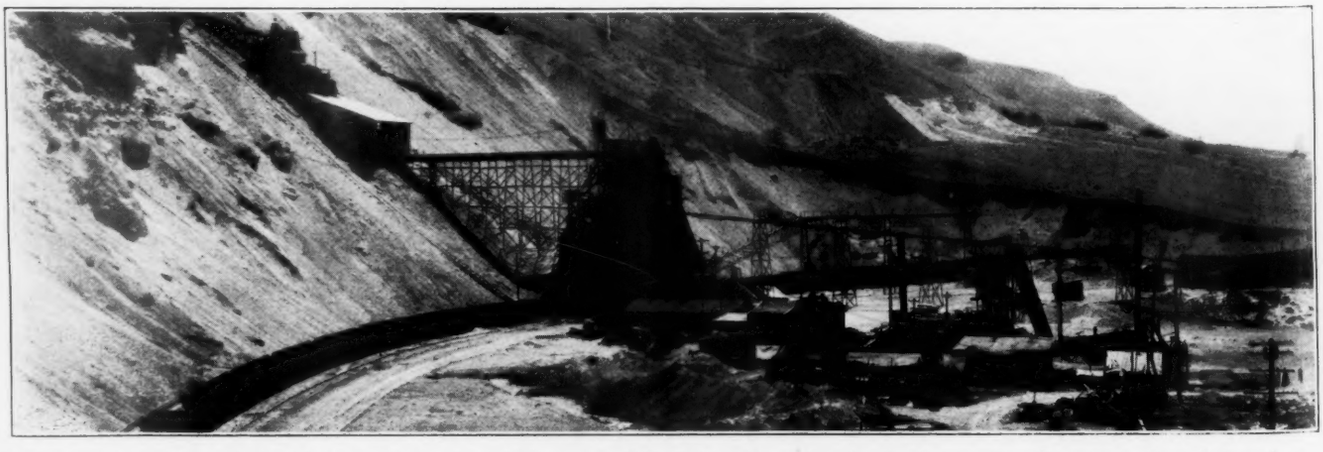


Fig. 2. Operations of the Utah Sand & Gravel Co. near Salt Lake City. In the background a limestone deposit has been opened.

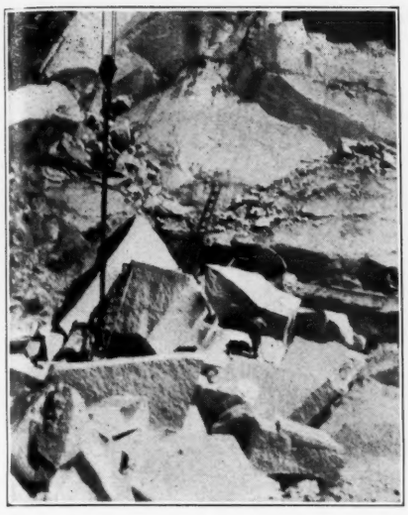


Fig. 3. Quarry of Utah Granite & Marble Co. near Salt Lake City.

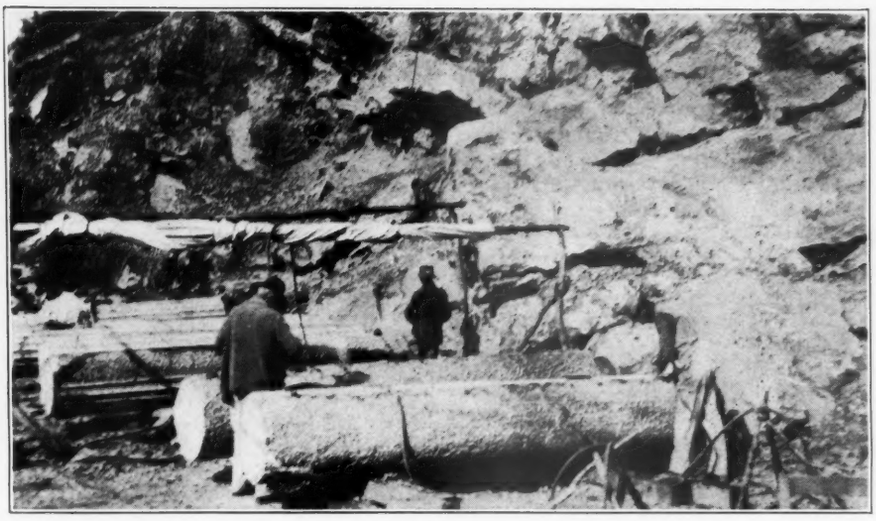


Fig. 4. Workmen fashioning columns in the quarry of the Intermountain Marble Co. near Thistle in Utah County.

Building Stones.—Utah is favored with large supplies of a great variety of building stones. Mention has been made of granite. A great deposit is located within 20 mi. of Salt Lake City and other deposits are known elsewhere. A number of the more important buildings in Salt Lake City have been constructed of granite from Little Cottonwood Canyon. Those include the great Mormon Temple, the famous tabernacle and the assembly hall, all located in Temple Square; the beautiful state capitol; St. Mary's Cathedral; the administration building of the L. D. S. Church; and numerous other structures. The granite is of superior quality, particularly hard and weather-resistant and presents a striking appearance, being light gray with a sufficient percentage of darker ingredient to give it character and warmth. In Fig. 3 is shown a general view of the granite quarry of the Utah Granite & Marble Co. in Little Cottonwood Canyon within 20 mi. of the center of Salt Lake City.

A subsidiary use of granite is the facing of caststone with granite particles, particularly for caps, sills and even foundations, steps and columns.

Marble of high quality, excellent texture and a wide range of color from pure white to plain black is found in various portions of the state, and there has been considerable exploitation of several quarries, particularly of those producing what is known as Utah Birdseye and Golden Travis marble. The latter is a golden-brown marble, which is beautifully marked and has been employed in many interiors, not only in Utah but in numerous other states. It is being used for the exterior of the new L. D. S. Chapel now under construction in Washington, D. C. Several varieties of Utah marble are to be seen to excellent advantage in the state capitol and the L. D. S. administration building in Salt Lake City. Fig. 4 shows the quarry of the Intermountain Marble Co. near Thistle in Utah County. Monoliths for the L. D. S. administration building are shown in process of fluting.

Closely allied with the marble is travertine, which also is found in a number of localities. It, too, is of high quality and is to be had in a wide range of color and markings and has been used in numerous interiors here and elsewhere.

Utah onyx is one of the best-known local materials of construction and may be seen in a number of the outstanding monumental buildings in this region.

Subsidiary use of both marble and onyx for terrazzo installations is of common occurrence. Utah marble and granite find extensive use for monumental purposes.

Limestone is somewhat generally distributed and has had a considerable application as a structural material. In southern Utah red limestone is found. Elsewhere the color ranges from white through gray to blue and black. As a building stone limestone has proved resistant to normal weathering and particularly to the corrosive action of alkaline salts. Dolomitic limestone occurs in several localities.

In southern Utah and elsewhere lava rock is used for structural purposes, either as naturally rounded bowlders or as cut stone. In its amorphous form it is highly resistant to alkaline action and thus is particularly valuable for foundation purposes. In its crystalline form it is less resistant to corrosion but is more easily cut for use as ashlar masonry.

In various portions of the state schist, quartzite, gneiss and trap-rock fragments and calcareous tufa are used for construction purposes, particularly of residences and small commercial buildings, schools, churches, and other structures. These same materials also find extended use for walls, rock gardens and other special purposes.

Needless to say, sandstone is found in every portion of the state. In color, texture and quality the range is extremely wide. In southern Utah and other particularly arid portions of the state unbelievably brilliant reds, vermilions and pinks prevail although white, grey, greenish and brown sandstones are found in close proximity. Some of the sandstones are highly satisfactory for structural purposes and have been used for a number of imposing buildings throughout the state. Other stone, due to the character of the cementing in-

gredient, is not so resistant to weathering but finds use in minor structures. Several deposits have been worked for the production of grindstones and whetstones.

A growing use for sandstone in thinner stratification is for flagstones. Other stones in Utah are employed for this purpose also.

Utah has several deposits of a most interesting structural material known as oölitic limestone. It has the appearance of gray sandstone but the particles are minute spherical concretions of lime. The stone is softer than ordinary limestone and is easily cut. It is satisfactory as a building stone for arid climates and particularly where the freezing of interstitial water is not likely to occur. Considerable quantities have been shipped to California and elsewhere and several important buildings in Utah have been constructed of it, notably the administration building of the University of Utah.

When the parent rock disintegrates it leaves a fine-grained deposit known as "oölitic sand" which, of course, is not a sand at all. "Oölitic sand" also is found along the shores of Great Salt Lake and on its bed in shoal water, being deposited when the lime-bearing river waters commingle with the brine of the lake.

Utah has several commercial deposits of slate which are susceptible of development for roofing and like purposes in line with future demand.

Lime, Cement and Gypsum.—Due to the wide distribution of limestone deposits, a large proportion of the communities of the state are supplied with kilns for the burning of plastering lime. At

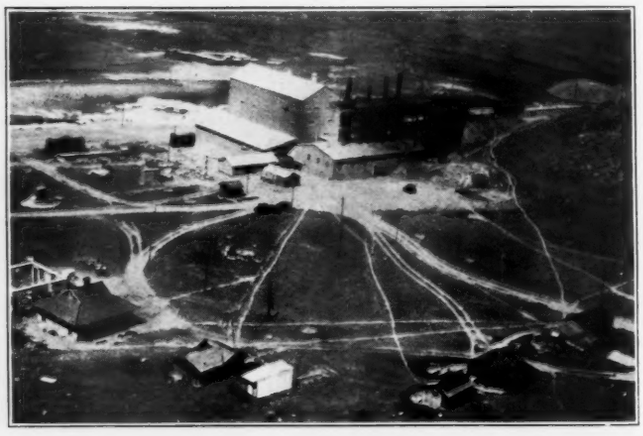


Fig. 5. Plant of Utah Lime & Stone Co. at Dolomite, Tooele County.

a number of the more important quarries limestone is quarried for use by sugar factories in the production of beet sugar, by smelters and other industrial plants as a flux, and by cement plants in the production of Portland cement. The annual production of lime is over 45,000 tons, valued at approximately $375,000. Fig. 5 shows the plant of the Utah Lime & Stone Co. at Dolomite in Tooele County.

Associated with limestone is calcite, a pure calcium carbonate, of which Utah possesses several important deposits. This material has various uses but at present it is largely employed in the poultry industry, where it is an important factor in the production of the well-known Utah milk-white eggs.

There are three Portland-cement plants in the state, one at Salt Lake City, which obtains its major raw materials in the Wasatch Mountains immediately east of the city; one at Devil's Slide, which obtains its materials largely from mountain deposits adjacent to the plant; and one near Brigham City, which obtains its chief materials by steam-shovel excavation from a lake-bed deposit adjacent to the plant, the lime constituent being secured in the form of marl. The total investment for the

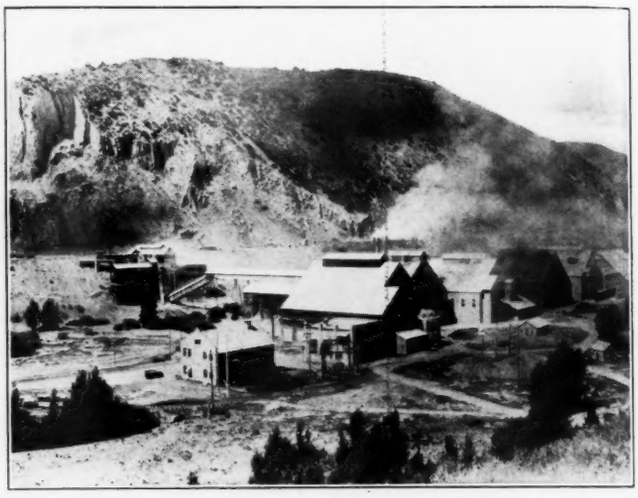


Fig. 6. Plant and quarry of Union Portland Cement Co. near Devil's Slide in Morgan County.

three plants is about $5,000,000 and the average output is about 500,000 bbl. per annum. In Fig. 6 is shown the quarry and plant of the Union Portland Cement Co. near Devil's Slide in Morgan County.

Whole mountains of gypsum occur in several localities in central Utah and two areas are being exploited at present, plants being located at Nephi in Juab County and Sigurd in Sevier County, where dental, casting, lava, finishing, acoustical, and hard plaster, and Keene's cement are produced. Raw product is supplied to Portland-cement plants in Utah and elsewhere and is also shipped to California for the manufacture of stucco and other plaster products. Some 45,000 tons of gypsum is mined yearly, the value being nearly $300,000.

Clay.—Clay is widely distributed in Utah and is to be found in numberless varieties. Rarely is it residual, however, and for this reason there has been but little exploitation for ceramic uses of the finer order.

It has been said that streams entering old Lake Bonneville carried the finer materials farther out into the lake. For this reason much of the bed of the former lake is clayey in nature, although usually mixed with sand or modified by alluvial deposits of sand and silt laid down by meandering streams subsequent to the desiccation of the lake.

Other deposits of clay usually represent alluvial deposition of eroded materials and in many cases have proved satisfactory for the production of heavy clay ware. The clay-products industry, therefore, has to do largely with common and face

brick and hollow building tile, although sewer-pipe and drain-tile production are important items. Other structural products are platform paving brick, flue lining, wall coping, roofing tile, clay shingles, floor tile, art tile, and promenade tile. With respect to face brick it should be said that Utah is particularly favored by reason of the bewildering variety of colors, shades and textures that are to be had. Few localities can compare with this state in this respect.

There are a score of clay-products factories, well distributed over the state, two-thirds of which are local in character and activity and devoted exclusively to the manufacture of common brick. Several of the plants manufacture only common brick and face brick. To these products several plants add hollow building tile or drain tile or both, while one of the largest concerns manufactures the whole group of heavy clay ware, including common brick, and another large concern produces the whole group of heavy clay ware, except common brick, and in addition manufactures assayers' supplies, silica brick, silica block, and flower pots. Fig. 7 shows the plant of the Salt Lake Pressed Brick Co. located in the environs of Salt Lake City.

The total investment in the several plants is at least $5,000,000 and the normal annual output is valued at about $1,000,000. In Fig. 8 is shown one of the clay pits of the Utah Fire Clay Co. located near Lehi in Utah County.

Utah's clay deposits are being studied and it is confidently expected that the future will witness an extensive exploitation of the clay resources and the development of an extensive ceramic industry, including porcelain, white ware, colored pottery and other finer examples of the ceramic art, as well as paving brick, terra cotta and fire brick.

Kaolin is found in several locations and there is one enormous deposit of material having the same chemical combination as kaolinite.

Fullers' earth has been marketed from several deposits and recently a clay resembling fullers' earth, but having superior properties for clarification purposes, has been exploited. This clay is mined and refined near Aurora in Sevier County and is sold largely to oil refineries.

In many localities clays have been consolidated into shales and find use in secondary road construction.

Bentonite has been reported in several localities.

Silica.—In the manufacture of the refractories mentioned heretofore silica is employed largely. In the early history of the state glass container ware was manufactured at Salt Lake City and it long has been known that there are numerous silica deposits in the state. It is only recently, however, that attention has been drawn to the fact that Utah's silica represents a most important resource. Not only are there many deposits, some of enormous proportions, located in various portions of the state, but tests indicate that Utah silica possesses certain distinct advantages for glass manufacture. In the first place it melts at a temperature of 100 deg. F. lower than Belgian silica and in the second place only three-fourths of usual proportion of soda ash is required as a flux. Finally, some of the deposits contain minute percentages of titanium oxide which tends to give a lavender tint to glass which negatives the tendency of iron to give a greenish tint, thus making it feasible to use silica having a higher percentage of iron than the usual maximum.

Utah is ideally situated to become a great glass-producing center. Its exclusive trade zone warrants the installation of container and pressed ware plants, while its central position in the group of eleven western states points to the feasibility of the establishment of a great plate-glass plant.

At present silica is used largely as a flux, although it has a market in the crude state for a number of other uses. Large out-of-state shipments are made.

Silica in Utah occurs in three forms, silica sand, rock silica and in a semi-compacted form that can be broken down without grinding merely by heating and then plunging in cold water. Fig. 9 shows an enormous deposit of rock silica of a high degree of purity. The exposed face is well over 100 ft. in height. The deposit is located in Ward Canyon in Davis County about 12 mi. from Salt Lake City.

Salt.—Vast deposits of salt exist in Utah, enough to supply the whole world for a thousand years to come. The Great Salt Lake itself contains some 6,000,000,000 tons of salines in solution, mostly common salt. The adjacent Great Salt Lake Desert contains many billions more. Salt deposits are located in Juab, Sevier and San Pete Counties. Salt is accumulating constantly in Great Salt Lake and other saline remnants of old Lake Bonneville and will continue to do so forever.

In the salt mines the salt is excavated from un-

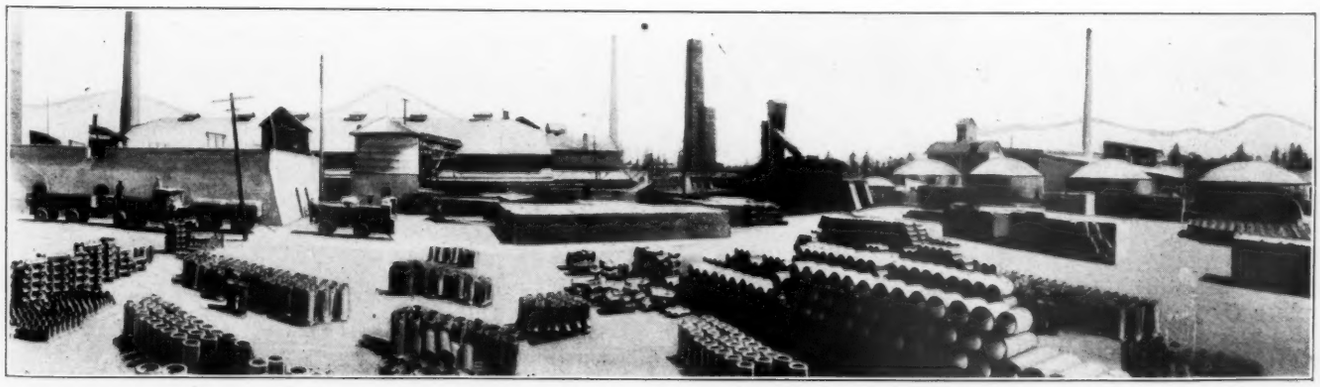


Fig. 7. Brick and tile plant of Salt Lake Pressed Brick Co.

Fig. 8. Clay pit of the Utah Fire Clay Co. near Lehi in Utah County. Fig. 9. (*At right*) Rock-silica deposit, Davis County.

derground deposits as crude salt and as rock salt. The former is pressed into blocks for the use of livestock while the latter is ground and sieved into grains of various sizes for poultry feed, dairy uses, etc. The crude salt is naturally iodized, and, for livestock purposes, sulphur is added before the blocks are pressed. A salt mine located near Redmond in Sevier County is shown in Fig. 10. The desert deposits may be scraped up into mounds and then transported to the mills for refining.

Salt is obtained from the Great Salt Lake and from salt springs and percolating salt water by the solar evaporation process. The brine is pumped into salt ponds and allowed to evaporate by the combined action of the sun and the wind. When a considerable depth of salt has accumulated, it is scraped up into mounds and allowed to dry, after which it is transported to the refinery where it is purified, graded and sacked for marketing.

The present annual production amounts to approximately 80,000 tons, valued at about $400,000.

In passing it may be well to point out that the Great Salt Lake brine and the Great Salt Lake Desert deposits contain other valuable materials, chiefly calcium, magnesium and potassium, together with compounds of sodium other than the chloride.

Sulphur.—Utah has several commercial deposits of sulphur, chief among them being one at Morrisey in Beaver County, now being worked, and one in San Rafael canyon in Emery County, which is as yet undeveloped.

The Morrisey deposit, the largest in the state, covers a square mile of territory and represents the impregnation of decomposed rhyolite by sulphur water from deep subterranean sources. It has been worked for nearly a half-century. The raw material is excavated by means of steam shovels and is refined at the site.

Sulphur is produced as flowers of sulphur, sulphur flour, crude sulphur and sulphur concentrates, the last-named finding wide use in California and elsewhere as a soil corrective.

Hydrocarbons and Oil Shale.—The Uinta Basin is noted as containing the largest deposits of asphalt and related bitumens in America. In this region are found Gilsonite, locally termed Uintaite, elaterite, otherwise known as Wurtzilite, and ozokerite, also known as Utahwax. The only other places in which these rare minerals exist in large quantities, so far as is known, are Galacia, Roumania and Baku.

These bitumens resemble tar, except that they possess a greater gloss and hardness when cold. They are residues of petroleum and have important uses in the manufacture of asphalt and high-class varnishes, japans, insulation, mineral rubber, acid-proof paints and water-proofing compounds. Gilsonite is an important source of asphalt. Veins range from a few inches to 18 ft. in width. One mine near Watson, in Uinta County, has developed one vein for a distance of 3 mi. and to a depth of more than 400 ft. in places. Select Gilsonite is found at a depth of 70 ft. below the surface.

Elaterite is found in both Carbon and Wasatch Counties, in the vicinity of Strawberry Creek. Veins range from 1 to 20 in. wide. The ore is sacked and hauled to the railroad for shipment to refineries.

Ozokerite has been mined from an area in Central Utah, 12 mi. long and from 1 to 4 mi. wide, near the towns of Colton and Soldier Summit, in Carbon and Utah Counties. A mine and refinery are located at Soldier Summit. Ozokerite also occurs in irregular vein deposits in fissures and crushed zones in limestones, shale, and sandstone. The chief products of the refinery at Soldier Summit are ceresine wax, used as the base for floor polishes, and electrotyping wax. The final residuum of the refining process finds a market as the base of waterproof filler for tarpaulins.

Rock asphalt is mined in Carbon County and has been used in a number of states for paving purposes. It is useful also for surfacing playgrounds and tennis courts.

Asphaltic limestones and bituminous sandstones exist in large quantities but have not been mined as

yet. Utah also possesses large measures of oil sands, sands from which the "free" petroleum has drained away, but which contain an even greater amount of capillary oil which may be distilled easily from the sands. The structures are such that the oil sands may be worked with steam shovels and it is certain that the measures will be exploited when the price of petroleum warrants such operations.

Utah has been endowed with a generous share of oil shale. In the Uinta Basin alone the United States Geological Survey estimates there are over 92,000,000,000 tons of shale which will yield, when distilled, as much as 15 gal. to the ton. "Shalene," as it is called, is superior to gasolene as a fuel for internal-combustion engines and shale oil is superior to ordinary petroleum lubricants. Because of the low prices of petroleum, and the fact that special carbureters would be required for "shalene," exploitation of shale on a commercial scale has not been attempted, but whenever natural-oil supplies fail, by reason of the vast tonnage of shale existing within the borders of the state Utah should take its place as a leading producer of shale oils.

Another interesting hydrocarbon is the cannel coal found in the extreme southern portion of the state, not far from Zion National Park. This material is valuable not only as a source of oil but for an imposing list of chemical compounds, drugs, dyes, mordants, perfumes, extracts, etc. A deposit of jet is found in the same locality.

Petroleum has been found in several portions of the state and, while no extensive workings have been developed, there is every reason to expect that important fields will be opened. In addition to petroleum, special oils are available from the hydrocarbon deposits, some of which have found use for medicinal and other purposes.

In drilling for oil natural flows of carbon dioxide and helium gas have been developed. Installation of a carbon-dioxide ice plant has been made in connection with one of the carbon-dioxide wells, while the helium field has been reserved for government purposes. Explosives are to be produced in connection with the ice development.

Semiprecious Stones.—In addition to the jet, Utah produces a number of semiprecious stones and stones used in the finer arts. Reference has been made heretofore to marble and onyx. These materials find use for carving as well as for structural purposes. Agate, chalcedony, jasper, garnet, opal, obsidian, olivinite, rock crystal and topaz are found in various counties of the state.

Fig. 10. Open-cut salt mine near Redmond, Sevier County.

Alunite.—Utah has enormous deposits of alunite which are destined shortly to become an important source of metallic aluminum. At present they are being used for the manufacture of potash fertilizers, with alum as a by-product, while the ground raw material is the base of a nationally-known cleaning compound that will not scratch silverware or porcelain-surfaced articles. Potash is found elsewhere in the state and in forms other than alunite.

Miscellaneous.—Diatomaceous earth and other rare earths are found in various portions of the state.

Volcanic ash, basalt, and pumice are found throughout a considerable area of the state. The latter has been utilized in the manufacture of mechanic's soap and in the preparation of an abrasive cleaning compound.

Phosphate rock is reported in several of the northeastern counties.

Utah has deposits of feldspar, fluorspar, talc, mica, mirabilite, petrified wood, and many, many other useful substances.

It is hoped that the State Geological and Mineralogical Survey, which was created by the 1931 legislature, will be provided with an appropriation in the near future which will make possible a comprehensive survey of the nonmetallic resources of the state. In the meantime the Utah Engineering Experiment Station at the University of Utah is coöperating with the Industrial Department of the Salt Lake City Chamber of Commerce in collecting such material and information as is possible with the limited funds available to the end that some service may be rendered to interested persons or concerns making enquiry.

Hydraulic-Cement Production Shows Decline from Preceding Year

Hydraulic cements other than Portland cement, —which include natural and pozzuolan cements and masonry cements of the natural cement class—produced in the United States in 1931 amounted to 1,241,803 bbl., which represents a decrease of 30.7 per cent. in comparison with 1930. In 1931 there were shipped from the mills 1,226,850 bbl. of these cements, valued at $1,619,920 a decrease of over 31.3 per cent. in quantity and of 34.4 per cent. in gross value as compared with 1930. Stocks at the mills increased and were 7.4 per cent. higher at the end of 1931 than at the end of 1930.

These statistics represent the output of 12 plants located as follows: One each in Illinois, Indiana, Kansas, Kentucky, Ohio, and Pennsylvania; and two each in Alabama, Minnesota, and New York. In addition to the 11 plants that reported output in 1930, one plant located in Alabama, reported the production of pozzuolan cement in 1931, and its output is included in the figures for that year.

Rigid Specifications for Concrete Seen as Aid to Central-Mixing Plants

Demand for Superior Product Eliminates Competition from Material Mixed on Job

By JOSEPH A. KITTS
Consulting Concrete Technologist
San Francisco, Cal.

THE information given herein for use in preparing a purchase specification for ready-mixed concrete presents our interpretation of the fundamental considerations involved in formulating specifications which will take advantage of the special facilities and economy of central-plant proportioning and transit mixing and delivery of concrete.

A modern specification for concrete production, whether done on the job or at a central plant, should require: (1) modern facilities for weighing the ingredients and measuring the water; (2) efficient mixing and transporting facilities; (3) laboratory control of proportioning; (4) the utilization of the established basic principles of mixture formulation; and (5) essential measures of workmanship in placing.

The loose specification, requiring no particular plant facilities for accurate measurement of the ingredients, puts the modern central-plant facilities at a disadvantage when compared with the ordinary job plant and the inferior product of this job plant in strong competition with the superior product of the central plant. Arbitrary proportion specifications do not take advantage of the superior facilities of the central plant to provide concretes of given qualities with greater economy, and are conducive to unfair competition disadvantageous to both the central plant and the buyer of concrete. Specifications which do not provide for skilled technological control of production put the central plant in competition with inferior methods which do not utilize the superior facilities of the central plant.

What is needed, then, is a modern concrete specification, not particularly for ready-mixed concrete, but one, applying to all concrete, which will not put the central plant in unfair competition with inferior facilities and methods which produce inferior concretes with no saving in cost to the owner of the structure in which the concrete is used.

Strength Concrete Under Buyer Control.—The buyer sometimes specifies concrete of a given strength, made under the control of technical personnel of his own selection, without provision for payment on the basis of the cement used. This is obviously unfair to the central plant. While it is proper, and often necessary as a part of central-plant production, to permit the engineer or concrete technologist for the buyer to control the concrete proportioning, the specifications in this case should provide for payment on the basis of the cement used, and for a proper check on the yield of mix combinations. In this situation, the central plant should coöperate fully to produce concrete of the quality specified but should not be held responsible for the quality in so far as it is not within its control.

Strength-Test Error and Tolerance.—The specifications of compressive strength often require a minimum test, in any one specimen, not less than that of the basis of the design or specified strength. In other words, the minimum test, rather than the standard average test, is required as the measure of the strength of the concrete.

In view of the facts established by Gonnerman in his bulletin on *Effect of End Condition of Cylinder on Compressive Strength (Test) of Concrete*,[1] that very slight defects in the capping of cylinders give very large minus results, it is obvious that the minimum test is only a fraction of the actual strength of the minimum-test specimen itself, and the minimum-strength test decreases as the number of tests and test days increases.

It has also been established by Abrams and others that lack of moisture in curing may give as low as 40 per cent. of the actual or potential strength of the concrete. Under abnormal job conditions it is not always practicable to maintain standard curing conditions for specimens because extra expense is not provided for in the contract.

Bulletin No. 81, Engineering Experiment Station, University of Illinois, shows that mean curing temperatures of 30 deg. and 50 deg. F. give (at 28 days) 56 per cent. and 82 per cent., respectively, of corresponding tests of specimens cured at the standard temperature of 70 deg. F.

It would appear that the average test of specimens made and cured under job conditions, with the best practicable care to effect standard requirements, is about 80 per cent. of the actual strength of the concrete.

Compression-test measurements follow the law of probability and error just as do any other measurements, excepting that very small defects, difficult to avoid in the capping of specimens, cause very large minus errors, while plus errors are mostly due to the personal equation and are easy to avoid. There is considerable evidence that the maximum test of a number of specimens of the particular mix at a given time is more nearly its actual strength than the average test.

The minimum test of any particular concrete progressively recedes as the number of test specimens is increased and, theoretically, with an infinite number of tests the minimum test of any practicable strength concrete becomes zero. Therefore,

[1] Bull. 14, Structural Materials Research Laboratory, Lewis Institute.

the minimum test or minimum strength is indeterminate, and the average test, of a sufficient number of samples to give a fair average, of specimens made, capped and cured as strictly and as accurately as practicable in the standard manner, is the only practical measure of the strength, and, the evidence of available data would indicate that it is a conservative measure of its actual strength.

In view of the inherent and unavoidable minus error of the compression-test measurement, a tolerance in the average of any one set of specimens is a practical necessity. Otherwise, a large margin of excess strength is provided in the mix formulation in addition to that already provided in the usual structural design, and the buyer pays for more safety than is warranted by good engineering. We should remember that the strength of the concrete continues to increase after 28 days.

Slater and Walker in their 1925 report to the Joint Committee, on field tests employing the tables of proportions as contained in the report of the Joint Committee, suggest a tolerance of 10 per cent. of the specimens less than 80 per cent. of the designed strength, with an average equal to or greater than the designed strength.[2] This would appear to be a reasonable tolerance under job conditions in view of the evidence that the average test measure of job samples approximates about 80 per cent. of the actual strength.

The tests of Clemmer and Burgraff [3] indicate that the average compression test is about 80 per cent. of the actual strength as indicated by the uniformity of the corresponding flexural tests.

In any event it should be appreciated, in writing a specification for strength concrete, that the compression test is merely an approximate measure of the actual or potential strength, and that the errors difficult to avoid are in the minus direction. Some definite tolerance in the average test measure of a set of specimens is practically and technically demanded in the circumstances.

In changing from customary arbitrary proportions to strength concrete, the architect, engineer and owner have been prone to demand a minimum test, in any one specimen, equal to the basis of the structural design, 2,000-lb., 2,500-lb., 3,000-lb., etc. concrete, although previously satisfied with 1:2:4 concrete, for example, varying in strength tests from 500 lb. minimum to 4,000 lb. maximum with 1,500 to 2,000 lb. as the average. Both extremes are due to the lack of a thorough understanding of actualities, and therefore, the strength specification and test tolerance should be so definitely stated that it can not be misinterpreted by the layman in concrete physics. It should be remembered that the user of the concrete pays for any excess safety factor of the strength test specified.

Under our system of technological control of concrete production, as indicated by the *Elements of Concrete Specifications* appended hereto, the essential tolerances in the compressive-strength test of ready-mixed concrete are considerably less than indicated by the Slater and Walker report of the Joint Committee, provided reasonable care is taken to conform practically with the standard requirements of making, capping and curing.

Seventy-four individual 28-day compression tests were made during a period of 13 hr. in the production and placing of 779 cu. yd. of 4,000-lb. concrete. Specimens were taken on the job and cured and tested, independently, by representatives of the producer's laboratory, and by two commercial laboratories, representing the owner and general contractor, respectively. Commercial laboratory *A* took samples from the same batches as producer's laboratory *P*, and commercial laboratory *B* took samples independently. Two basic mixtures were used: Mix No. 1: 4,000-lb., 1½-in. (square hole) maximum size of aggregate, and 6-in. slump; and Mix No. 2: 4,000-lb., 1½-in. (square hole) maximum size, and 7½-in. slump. Eight hundred forty-six pounds of cement per cubic yard of set concrete was employed in mix No. 1, and 958 lb. in mix No. 2. The average measured slump of mix No. 1 was 6¼-in., and that of mix No. 2 7¼-in. The measured and computed cubic yardage was 779, and the production cubic yardage 778, an error (?) of slightly more than one-tenth of one per cent. in favor of the buyer.

The maximum, minimum, total spread, average strength, and percentages of the specified strength of the 74 specimens, were as follows:

	Strength *(lb. per sq. in. at 28 days)*	Percentage of 4,000
Maximum	4,720	118
Minimum	3,457	87
Total spread	1,263	31
Average	4,099	102

The maxima, minima, averages and percentages of specified strength for each laboratory were as follows:

Laboratory	P		A		B	
	Test	Percentage of 4,000	Test	Percentage of 4,000	Test	Percentage of 4,000
Maximum	4.582	115	4,502	113	4,720	118
Minimum	3,846	96	3,809	95	3,457	87
Average	4,167	104	4,055	101	4,075	102

Thus, the 74 tests show not more than 2 per cent. of the tests less than 88 per cent. of the specified strength where the average is 102 per cent. and the maximum 118 per cent.

The 8 lowest tests were: (1) 3,457, (2) 3,473, (3) 3,577, (4) 3,599, (5) 3,602, (6) 3,809, (7) 3,838, and (8) 3,846. Thus, not more than 10 per cent. of the tests were less than 96 per cent. of the designed strength where the average was 102 per cent. Two of the laboratories showed no tests lower than 95 per cent. of the required strength.

Considering the inherent minus error of the average compression test, the minimum test is due to the maximum minus error in accordance with the mathematical principles of probability and error. In view of what we know about the causes and extent of minus error of the average test and of the minimum test, it would be conservative to assume that this minimum test is 75 per cent. of the actual

[2] See par. 22, p. 6, Proceedings, A.S.C.E.; Jan. 1925.
[3] See p. 304, Vol. XXII, 1926, Proceedings American Concrete Institute.

strength. From any point of view, it can be seen from these tests that central-plant concrete made under skilled technological control is very much more uniform in strength than the usual commercial tests indicate, appreciating that these tests were made under competitive conditions demanding the greatest care and accuracy of which each laboratory was capable.

Tolerance must provide for ordinary care under job conditions, but, no tolerance can provide for indifference and lack of knowledge of the essentials of molding, capping, and curing, and loading of the test specimens. Central-plant concrete can be made with such accuracy and uniformity day after day, that the concrete measures the careless laboratory, instead of the laboratory measuring the concrete.

The tolerance, it would appear, should be applied to the average test, of the standard set of samples taken at a given time, as the curing conditions alone will affect the whole set in the same manner. The strength requirement and tolerance may well be stated as follows:

(a) The average strength, indicated by the average of all standard sets (2 or more?) of samples of the (2,000-lb.) concrete, shall not be less than (1,035) lb. per sq. in. at (7) days, nor less than (2,000) lb. per sq. in. at (28) days.

(b) There shall not be more than (10 per cent.), of the whole number of (7)-day plus (28)-day standard-test sets, showing averages less than (90 per cent.) of the (7)-day and (28)-day requirements given in (a).

(c) The relation of 7-day and 28-day strengths, for normal standard Portland cement, shall be based on the Bureau of Standards formula,

$$S_{28} = S_7 + 30\sqrt{S_7}$$

Where moist curing is neglected, the 7-day test and the corresponding 28-day strength determined by the formula, are more representative than the 28-day test.

Size Separations of Aggregates.—As it has been customary to specify two aggregates, fine and coarse, having certain grading limitations, the same demand is made of the central plant. As a matter of practical necessity, the central plant must have its aggregate separated into several sizes, such as 0 to 1/16-in., 0 to 3/16-in., 3/16-in. to 3/8-in., 3/8-in. to 3/4-in., 3/4-in. to 1 1/8-in., 1 1/8-in. to 1 1/2-in., 1 1/2-in. to 2-in., 2-in. to 3-in., 3-in. to 4-in., etc., in order that concrete of any required maximum size may be supplied the buyer. It is one of the important and valuable advantages of central-factory facilities that these separate sizes may be accurately combined, batch by batch, into uniform and perfect gradings not possible with a lesser number of separations. It makes it possible to produce architectural concrete of the same texture as long as the supply of aggregates, of the particular lithological character, is available.

For a given cement content, maximum size of aggregate and slump of concrete, the concrete of best quality can be made from the greater number of size separations, and an inferior product results when already separated sizes are pre-mixed before delivery to the concrete plant or the weighing batcher. Therefore, the specifications should provide that the mixtures shall be formulated with regard to the actual gradings of the several individual aggregates supplied by the central plant, rather than that certain gradings of fine and coarse be supplied to fit an assumed mix. (Standardization of size separations of aggregate is a crying need and the problem is one to which the ready-mixed-concrete industry should contribute the main effort for a proper solution.)

Concrete Flowability.—Present-day specifications often require lower slumps than practicable from the point of view that the strength depends upon the slump, when, as a matter of fact, this is true only for a given cement content and water-cement ratio. The contractor is prone to want, *e. g.*, strength concrete of 6-in. slump with 3/4-in. maximum-size aggregate at the time of purchase, and 7 1/2-in. to 8-in. slump at the time of use.

In our opinion, the well-known criteria of proper slump lean too far towards dry mixtures, with excessive honeycomb, air bubbles, pour joints, and subsequent unsightly patching as results. It is generally more economical to use more slump than indicated by these criteria and the additional cement required by the increased water content. If the mix is just sufficiently fluid to hold its water, this is the optimum slump for workability, flowability and cohesion of the fresh mix, and strength, density and economy of the resulting concrete.

We recommend the following optimum slumps for various maximum sizes of aggregates:

Maximum Size (in.)	3/16	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	3
Optimum Slump (in.)	8.6	8.5	8.4	8.2	8.0	7.7	7.5	7.3	6.3	6.0

Under skilled workmanship or improved facilities of placing and puddling, less slump may be used as follows: Narrow reinforced walls and columns, 1/2 in. less; reinforced beams and floor slabs, 1 in. less; reinforced footings, 2 in. less; reinforced pavements, 3 in. less; and large or plain sections 1 in. less than the foregoing.

A tolerance of 1/2 in. less and 1 in. more slump than specified is ample and logical.

A specification should be written to provide for essential workability and to obviate the possibility of purchase of the cheaper-strength concrete with less slump and the subsequent demand for more slump and the same strength at the same price.

Specifications often require that the mixing water shall be added and the concrete mixed upon arrival at the job. This is a more costly procedure and does not get the benefit of thorough transit mixing.

Specifications seldom comprehend the basic principles or laws of mixtures in such a manner as to utilize the facilities provided by the modern ready-mixed-concrete plant to produce superior and more economical concrete. This is naturally the case as there is no accepted coördination of the many fragmentary principles of mixtures. The principle of mixtures most generally accepted, the Abrams water-cement-ratio strength law, is not adequate alone for the successful commercial production of concrete. The use of only two sizes of aggregates, fine and coarse, is impractical. Water-cement ratio

and trial mixtures are impractical. Arbitrary proportions by loose-moist, dry-rodded, and inundated bulk volume are impractical. Arbitrary proportions by weight are impractical. The voids-ratio theories, the Thacher sand-cement ratio, the Fuller or similar gradings, the Feret-Talbot cement-space theories, the Feret-Talbot-Richart-Kitts-Walker absolute volume measure, the surface-area and fineness-modulus principles, individually are impractical. However, all these fragmentary theories and methods have elements of basic principles of mixtures which must be coördinated in order to provide a concrete-mixture technology adequate to meet the requirements of the commercial manufacture of concrete.

Until this coördination is made and incorporated into the specifications, the concrete-manufacturing industry will be handicapped by ordinary-concrete competition and by its own inability to utilize its superior facilities. Better concrete can be produced by the ordinary job plant under skilled technological control, employing such a coördination of principles, than can be produced by the modern central plant operating without such technological control based on a coördination of all the known principles of mixtures.

We must first adopt the fundamental basis of measure as the practical basis of measure. The absolute volume is undoubtedly the fundamental basis of measure as indicated by the work and methods of Feret, Talbot, Richart, Walker, Kitts and others. We must determine and adopt the law of the yield of combinations of absolute volumes, as indicated by Feret *et al.* This is essential in the production and delivery of concrete correct in volume within one-half of 1 per cent.

We must know and adopt the law of the cement content for concrete of any strength for any given maximum size of aggregate and slump, in order to provide this unknown value in the Abrams water-cement ratio law. This is shown by the author in PIT AND QUARRY, Jan. 13, 1932, p. 102-105, and by Abrams in Fig. 7, *Tests of Powdered Admixtures*, Proceedings, A. S. T. M., 1929. We must coördinate the principles of filler-voids ratios, sand-cement ratios, cement-space ratios, gradings, surface area, and fineness modulus by the determination of the grading equation and optimum fineness-modulus law which fulfill these requirements.

Finally, the standards of measure of physical characteristics (as well as volume) of materials must be based, in all respects, on the absolute volume as the fundamental basis of measure, as in the case of the standard test for apparent specific gravity. Until this is done we will continue to grope with the ancient measures and ideas which have been outgrown by the advent of the modern central factory.

When this is done, the formulation of mixtures becomes a simple, accurate and expedient operation instead of an abstruse, slow, and erroneous one; and its greater scientific exactness is accompanied by a greater practicability.

Laboratory facilities at the plant are essential to both the producer and the consumer, and the specification should cover this subject adequately. Employment by the manufacturer of independent consultants to control and certify production is an arrangement particularly advantageous under the conditions peculiar to this industry, as it places an independent authority between the manufacturer and the buyer as referee to judge the product without bias.

Summarizing, the need of the modern concrete-manufacturing industry is a concrete specification, not of loose and limited requirements, but one requiring the modern plant facilities for measurement of materials, and for mixing and delivery, requiring expert laboratory and plant control, requiring the employment of a concrete technology comprehending all the known fundamentals of mixtures and of mixture formulation for concrete of essential quality, a logical specification, fair to all concerned, and one which leaves no important item to the vagaries of the lay specification writer.

Appendix

Elements of Concrete Specifications

(Providing for Concrete of Predetermined Quality with Fundamental Economy Sustained by Technological Control of Production)

Cement.—A.S.T.M. Standard Tested. Alternate A.—Cement paid for separately by the Owner. Alternate B.—Contract covers maximum of (1.6) bbl. per cu.yd. of concrete and owner is credited @ ($2.40) per bbl. with economy effected by technological control of concrete production.

Admixture.—Admixtures must be approved by the concrete technologist. Those required by the owner will be paid for by him.

Aggregates.—A.C.I. Standard Test, separated into (3 to 6) (commercial) sizes.

Concrete.—Minimum average A.S.T.M. Standard Compression Test at 28 days age: Class A ——— lbs. per sq. in.; Class B ——— lbs. per sq. in.; etc., maintained by the concrete technologist representing the owner (through the (Architect) (Engineer) (Builder) as agents for the owner.) (Tolerance providing for usual minus errors of the compression-test measurement is: Not more than (10 per cent.) of compression tests less than (80 per cent.) of the minimum required average test strength). Cement and water content and grading of mixed aggregate shall be determined by the concrete technologist as follows:

(a) Mixing water per cubic yard of concrete shall be in accordance with the Abrams water-cement ratio law;

(b) Barrels of cement per cubic yard of concrete shall be in accordance with the Kitts cement-strength ratio law;

(c) Grading of mixed aggregate shall be that producing concrete of optimum workability, flowability, cohesion, strength, and density, and economy of labor and materials; shall be graded uniformly by the Talbot-Richart or Kitts-Peugh equation; and shall be in accordance with the Kitts grading modulus law.

Standard slump (with particles over 1½ in. excluded) shall be in accordance with the Kitts optimum-slump law, and that for structural concrete shall not exceed the following schedule:

Optimum Slump (*in.*)	Maximum Size of Aggregate (*in.*)
¾	8.0
1	7.7
1¼	7.5
1½	7.3
1¾	7.1
2	6.8
2½	6.4
3	6.0

(A sufficient number of trials shall be made to give a fair average.)

(In the interpretation of this specification, it is the intent that the workability, flowability, and cohesion of the fresh mix shall be suitable for the purpose, that it may be placed without an extravagant expenditure of labor and with the minimum resulting honeycomb.)

Mixing time not less than (1½) min. while all materials are in the mixer.

Volume of concrete produced by the mixture of ingredients shall be determined in accordance with the Kitts yield-of-concrete law and shall be correct within one-half of 1 per cent.

Workmanship.—Labor of placing includes rodding, spading, tamping, hammering, vibrating, treading, etc. Competent labor of placing not less than an average of one man-hour for every (4) cu.yd. Placed in horizontal layers 3 to 10 times the maximum size of aggregate in depth; deposited vertically and separation prevented by the use of tremies, splash-boards, etc.; fresh concrete continuously deposited on fresh concrete after starting pour; columnar sections poured slowly to allow for shrinkage and continuously to prevent pour joints; and kept wet for not less than 10 days after placing and at a temperature not less than 40 deg. F. nor less than an average of 50 deg. F.

Plant.—Approved modern batch-mixers, cement- and aggregate-weighing batchers; mixing water weighed or metered with less than 1 per cent. of error; dry storage for cement; self-cleaning bins; slope of chutes not less than 1 vertical or 2½ horizontal; and such other equipment as may be essential to the delivery and placing of concrete and the prevention of setting or separation in transit. (The contractor with modern plant equipment can produce quality concrete more economically than one with antiquated equipment.)

Control of Concrete Production.—Pretesting of materials and concrete and control of the proportions of ingredients in the concrete mixtures shall be maintained by a concrete technologist, and workmanship in mixing, placing and curing shall be subject to his direction. The contractor shall coöperate fully with him to produce concrete of the quality and workmanship specified.

The concrete technologist shall provide one man-hour of efficient laboratory and inspection control for every (6) cu. yd. (average). Tests of materials shall be constantly maintained on the job and the absolute basis mix shall be sustained by varying the measured proportions as the quality of the materials varies and as the individual aggregates vary in moisture content, absorption, bulking, grading, density, specific gravity, etc.

The absolute basis mix shall be: (a) the absolute volumes and gradations of sizes of rock particles, (b) the absolute volume of cement per cubic yard of concrete, and (c) the absolute volume of mixing water; and these shall be determined by the concrete technologist for the particular conditions and purposes.

The concrete technologist will maintain a chronological record of tests of materials and proportions and make special tests and certifications as provided hereunder.

(No specification can produce quality concrete without the technically and practically skilled workman and no workman, however skilled, can produce quality concrete without the authority and facilities of a practical and scientific basis specification.)

Your future business success demands that you support the drive for a revival of general construction and an enlarged road-building program. Show your interest by attending the HIGHWAY AND BUILDING CONGRESS at Detroit, January 16 to 20. Your trade association will participate.

Japanese Cut Cement Output; Better Control of Exports Sought

Although many commodities in Japan are doing better, Japanese business is not taking the present opportunity to embark on new construction and cement demand has been falling gradually. For three months from September 1, the cement makers of Japan will curtail production by 57½ per cent. of capacity. The previous ratio was 56 per cent.

Leading companies are endeavoring to obtain better control of the export business, with the idea of doing away with competitive price slashing. Accordingly, they have taken advantage of the guild law to form an association for the exploitation of foreign markets. The new guild is not likely to be fully effective, for two reasons, but it is a start toward complete control of the market. The first of the reasons is that Onoda Cement, second-largest of the companies in the Empire, refuses to join. The second reason is that Manchuria, the East Indies and China, the three best markets, are excluded from the territory to be controlled.

Onoda is a member of the Japan Cement Assn. but four other small companies do not belong. Strenuous efforts are being made to bring these five concerns into line with the nine participants, and to establish export ratios on the basis of the averages for the past three years. Later it is hoped to include Manchuria, China and the East Indies into the territory covered by the guild.

Seaboard *(From page 28)*

jackets, which handle about 250,000 cu.yd. before they are worn out.

Organization.—The organization of personnel is shown in Fig. 9. The company has no safety organization, but the superintendent, assistant superintendent and timekeepers have all received instruction in first aid.

The following table gives a summary of costs for the full year of 1929 and the unit costs:

SUMMARY OF COSTS, JAN. 1, 1929, TO DEC. 31, 1929.

Total sand and gravel produced, 1,654,779 cu. yd. = 2,007,224 short tons
Operating Costs per Dry Short Ton of Sand and Gravel Produced

	Labor	Supervision	Power	Fuel	Supplies	Miscellaneous	Total
Dredging and pumping	$0.0559	$0.0030	$.....	$0.0142	$0.0445	$0.0338*	$0.1514
Crushing, screening, and washing	0.0510	0.0030	0.0369	.....	0.0466	0.0456*	0.1831
Total operating costs	$0.1069	$0.0060	$0.0369	$0.0142	$0.0911	$0.0794	$0.3345

Division	Percentage of Total Operating Cost
Labor	31.9
Power and fuel	15.3
Supplies	27.2
Supervision and miscellaneous	25.5

Labor per Ton of Material Produced	Man-hours
Dredge	0.0217
Plant	.0216
General (machine shop, floating equipment, repairs, etc.)	.0624
Total	0.1157

*Includes pro rata of towboat, truck, etc.

On the dredge 0.0024 ton of coal is consumed per ton of material produced. In the plant, 1.032 kw.-hr. is used per ton of material produced.

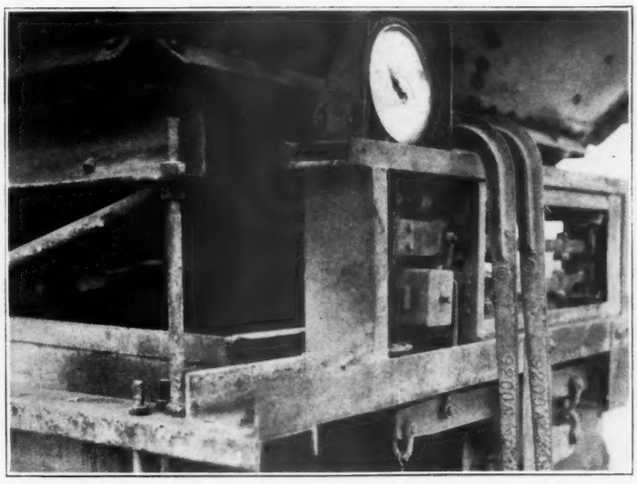
The batching plant and some of the storage and loading facilities at the yards.

Proves Worth of Pre-Mixed Concrete to New Orleans Building Industry

THE use of ready-mixed concrete for construction work in the city of New Orleans, La., has been growing rapidly in the last few years. Previous to that time New Orleans had been one of the most backward of the larger cities in the country in accepting this product. This change of attitude is largely due to the efforts of the J. J. Clarke Co., Ltd. which was the first to apply modern methods to the production and delivery of concrete in this city.

This company has been a material dealer for 75 yrs., and operates a warehouse and yard at Julia and Magnolia Sts., where a full line of building materials is carried. It entered the ready-mixed concrete field in November, 1930, with three Jaeger 2½-cu.yd. mixer trucks. A 220-ton steel-and-wood truck-loading bin was converted into a batching plant by installing Erie volume batchers under the bin gates. Shortly afterward a new batching plant was erected. This consists of a 2-compartment Blaw-Knox 150-ton steel bin with a Blaw-Knox 20,000-lb. weighing batcher equipped with a Howe 2-beam scale and a tell-tale dial. Sacked cement is loaded through a special chute into the trucks at the

Truck being loaded with concrete materials at the plant.



Close view of the batcher scale and tell-tale dial.

adjacent warehouse. The old plant is now used only when a customer orders volume-batched concrete.

The company operates a fleet of 11 Jaeger mixer trucks. Of these four are of 1½-yd., four of 2½-yd. and 3 of 3½-yd. capacity. All have the regular water-measuring tanks standard on these bodies and all but one have auxiliary gasoline-engine drives. Two are mounted on Packard, one on Ford, and the remainder on Mack chassis. With an average haul of from 1 to 2 mi. 450 cu.yd. of concrete can be produced in an 8-hr. day.

The location of the yard is ideal for the receipt of raw materials and for the delivery of concrete. It is on the New Basin Canal only ¾ mi. from the down-town section. Most of the sand is shipped in by barge and the pit sand and gravel from the district north of New Orleans are received by rail. Some slag and trap rock are also stored to meet occasional demands for special concrete. In addition to the batching plants, which can also be used for aggregate loading, the company has two 220-ton bins for loading aggregates to regular trucks.

That the company's product is acceptable for practically any kind of concrete construction is evident from the list of purposes for which it has been used. Among the larger orders was one of over 5,000 cu.yd. for the new 10-story Medical School of Louisiana State University. Ready-mixed concrete was used for the entire building, the walks, the driveways, etc. Other large orders were one of 1,400 cu.yd. for a 6-story building erected by the Standard Oil Co. of La., and one of over 1,000 cu.yd. for a new Sears-Roebuck store. Concrete has also been sold for wharves, markets, streets, sidewalks, private buildings, bridges, railway work, and some state and parish work. One sidewalk contractor alone used 2,200 cu.yd. on a single project. Most of the concrete for the larger jobs is sold on a strength basis and for smaller jobs on a straight-mix basis.

Cement Prices *(From page 20)*

As of June 30, last, Alpha had current assets, including $4,902,440 of cash and marketable securities, totaling $7,862,452, against which were current liabilities of $335,801.

Lehigh Portland Cement Co., which has an outstanding capitalization of 450,348 shares of common stock, par $50, and 197,594 shares of 7 per cent. cumulative preferred, par $100, for the 12 months ending with June reported a net loss of $484,020. This compared with a net profit of $1,631,440, equivalent to 46 c. a common share, after preferred dividend requirements, in the 12 months ended June 30, 1931. With the declaration of the $1.75 quarterly preferred dividend last June, the company stated future action on these shares depended on an improvement in earnings, the latter being possibly only in the 6,000,000 bbl. annually.

Pennsylvania-Dixie Portland Cement Co. for the 12 months ended June 30, 1932, showed a net loss of $1,643,140 after depreciation and depletion. In the preceding year the loss was $115,551. As of June 30, Pennsylvania-Dixie's current assets, including $2,756,989 cash and short-term securities, aggregated $5,446,660 and its current liabilities $409,555. The company has outstanding 130,988 shares of 7 per cent. preferred stock, par $100, on which dividends have not been paid since September 15, 1929, and 400,000 shares of no-par common stock.

For the six months ended June 30, last, International Cement Corp. reported a net loss of $759,241, as compared with net income of $1,000,627, or $1.57 a share, on the outstanding 636,124 shares of capital stock in the initial half of 1931. The company also has outstanding $17,995,500 of 5 per cent. debentures.

At the current rate of business, it is likely the company's loss for the entire year will approximate $2,000,000 after charge-offs for depreciation and depletion of in excess of $3,000,000, the latter figure being estimated on the basis of such deductions in previous years. During the height of prosperity of the cement industry, International's directors adopted a policy of making liberal charges for depreciation and depletion, which practice is being continued despite the recent decline in business and consequent earnings.

International during 1932 booked its full proportion of the business available. Currently, its domestic mills, which have an annual capacity of 18,000,000 bbl., are running about 30 per cent. of capacity.

A license has just been closed with one of the leading cement producers of Australia for the use of International's Incor process. Last year licenses were granted for the manufacture of Incor for Denmark, Norway, Sweden and Finland. Also, the company's Dallas, Tex., plant was equipped for the manufacture of this line, thus providing facilities for the making of Incor in five states—Pennsylvania, Indiana, Kansas, Texas and Alabama.

Incor, a high-early-strength cement, was developed by International's chemical engineers previous to 1928, in which year the company was granted patents in the United States and in all the principal foreign countries of the world.

International's foreign business is on a profitable basis, with the exception of Cuba, where general business conditions have been severely affected. The Cuban plant is running between 15 and 20 per cent. of capacity, while the South American plants —one each in Argentina and Uruguay—are operating at around 65 per cent. Foreign plant capacity of the company is about 6,000,000 bbl. annually.

Late in December or early in January, International will enter another South American country. In Brazil one of the most modern plants in the world is being erected at a cost of about $3,000,000. The capacity of this plant will be 800,000 bbl. annually, and provision has been made for the doubling of output in a short time if demand improves. The mill is close to its source of raw material and located conveniently on the Bay of Rio, thereby insuring cheap delivery to its principal market, the city of Rio de Janeiro.

MEN OF THE INDUSTRY

C. A. BEATTEAY

FIFTEEN or twenty years ago, when the city of St. John, New Brunswick, did a thriving business in lumber, C. A. Beatteay completed his education and entered the employ of Stetson, Cutler & Co., an important lumber manufacturer. As a sideline, the firm operated six kilns for the production of lime, utilizing mill waste as fuel. With the passing years, the lumber business waned, but Mr. Beatteay, then manager, saw the possibilities of profit in lime making and formed the firm of Snowflake Lime, Ltd., taking over that end of the business when the lumber interests were disposed of. Since then, the company has completely rebuilt the lime plant, acquired a new quarry and has prospered in proportion. Mr. Beatteay is secretary-treasurer and general manager of the concern, which has about 35 employees, most of whom were connected with the original lumbering firm.

Personal Mention

George A. Fisher, manager of the Yosemite Portland Cement Co., Merced, Cal., was recently elected a member of the board of directors to succeed **Frederick A. Thompson,** who resigned.

J. O. Strawn of Sherrodsville, O., and **W. Grant Dolvin** of New Cumberland, O., have leased the Mullet quarry near Dover, O., and have started operating. Finely pulverized material for agricultural use is being produced.

D. W. Yambert, for twelve years an engineer in the employ of the France Stone Co., has been appointed development engineer by the Patterson Foundry & Machine Co., East Liverpool, O. Mr. Yambert is a graduate mechanical and electrical engineer and in addition to his work with the stone company, had been connected with Marion Steam Shovel Co. and Fairfield Engineering Co. as development engineer.

Martin Burns, 52 years old, an employee in the primary-crushing department of the Universal Atlas Cement Co. quarry at Hudson, N. Y., suffered a fractured leg and severe facial lacerations while at work at the crusher recently.

L. A. Graham has been appointed sales manager of Falk Corp., Milwaukee, and **M. A. Carpenter** has been named sales promotion manager. Several new products have been added to the company's line of gears, speed reducers, etc.

Ralph L. Dunckel, formerly with the International Motor Co., has been placed in charge of production and purchasing at the Bridgeport plant of The Kron Co., Bridgeport, Conn., manufacturers of scales. Mr. Dunckel is a graduate of Cornell University.

J. D. Young, formerly of the Chicago sales office of The Wright Manufacturing Co., has become affiliated with the Chicago office of The Kron Co. in a sales capacity.

F. A. Emmons, vice-president and general sales manager of Foote Bros. Gear & Machine Co., recently made a trip through the east contacting Foote Bros. representatives in Pittsburgh, Buffalo, New York, Philadelphia, Washington and Richmond, Va. During the trip many calls were made on industrial firms in the various territories to get a check on the general situation and it was found that quite a number of factories are greatly encouraged by the changed outlook for business and were planning on starting increased production schedules in the near future. Mr. Emmons feels that this fall will mark a decided upturn in business.

John Pytlewski, employed in the crushed-stone quarry of the Consumers Co., Chicago, at Lemont, Ill., was seriously injured recently when he stepped from the crane he was operating into the path of an engine.

J. H. Dalbey has been appointed sales manager of the Cumberland Portland Cement Co., Cowan, Tenn.

L. S. Hemphill was elected president and general manager of the Mississippi Clay Co., of Charleston, Miss., at a recent meeting of the board of directors.

Mehl Roddick, for four years district road commissioner at Upland, Cal., has resigned to accept a position as superintendent of the Commercial Rock Co., of Upland.

Francis H. Wisewell, contracting engineer, has opened an office in the Cutler Building, Rochester, N. Y., and will specialize in the design and construction of elevating and conveying machinery installation. He was formerly with the United States Gypsum Co.

Harold E. Smith, secretary, Smith Engineering Works, Milwaukee, was elected president of Gyro International, men's service club group, at the recent annual convention held in San Francisco.

Obituary

Anthony Natale, 46 years old, locomotive engineer at the pit of the Nassau Sand & Gravel Co. near Roslyn, N. Y., was fatally injured while at work recently when the locomotive he was driving crashed into a train of loaded sand cars being pushed by another engine.

John Brogdon, working in a gravel pit at Delmar, Ala., was killed when 100 tons of gravel slid into a pit where he was working. It had been loosened by recent heavy rains. Four other workmen were partly caught in the slide, but were not seriously injured.

Coming Events

September 20-22, 1932. Chicago, Ill. Annual meeting, Roadmasters and Maintenance of Way Assn.

September 29-October 1, 1932. Pittsburgh, Pa. Annual conference, International Assn. of Public Works Officials.

October 3-7, 1932. Washington, D. C. Twenty-first Annual Safety Congress, National Safety Council. W. H. Cameron, secretary, 20 N. Wacker Drive, Chicago, Ill.

October 5-8, 1932. Atlantic City, N. J. Fall meeting, American Society of Civil Engineers.

November 14-18, 1932. Washington, D. C. Annual meeting, American Assn. of State Highway Officials.

December 5-9, 1932. New Orleans, La. Tenth Annual Asphalt Paving Conference and annual meeting, Assn. of Asphalt Paving Technologists. Under auspices of Asphalt Institute, 801 Second Ave., N. Y.

December 5-10, 1932. New York, N. Y. Tenth National Exposition of Power and Mechanical Engineering. Under management of International Exposition Co., Grand Central Palace. New York, N. Y.

Jan. 16-20, 1932. Detroit, Mich. Highway and Building Congress. Annual Conventions and Combined Show of National Crushed Stone Assn., National Sand & Gravel Assn. and National Ready-Mixed Concrete Assn., Book-Cadillac Hotel.

December 7-9, 1932. Washington, D. C. Annual meeting, American Institute of Chemical Engineers.

Traffic News and Comment

Recent I. C. C. Decisions

Lime.—The Interstate Commerce Commission in fourth-section order No. 10,680, dated Aug. 1, 1931, denied the western trunk-line carriers any further relief from the fourth section on shipments of lime. In order to eliminate fourth-section departures, the rates from river crossings and related points were changed, these changes resulting in both increases and decreases. At the request of shippers in western trunk-line territory and in Ohio the proposed schedules were suspended. At the hearing the carriers did not attempt to justify the suspended schedules, but suggested rates lower than those suspended. The rates they sought to justify were: (a) A minimum local rate from St. Louis to points on and south of the Santa Fe from Chanute, Kan., through Erie and Walnut to Frontenac, Kan., then on and west of the line of the K. C. S., through Gulfton to Neosho, Mo., thence north and east of a line through Baxter, Columbus and Parsons, Kan., to Chanute; (b) rates from the groups represented by Peoria, Chicago, and St. Paul to the same district based on the present differentials, corrected, over the rate from St. Louis; (c) proportional rates on traffic originating east of the Illinois-Indiana state line to be 1 c. lower than as proposed in (a) and (b) above; (d) rates from Neosho, Ste. Genevieve, Byers and Brickeye, Mo., to the district described to be 1 c. higher than from St. Louis; at present rates from these points of origin are generally 3 c. higher than from St. Louis. These proposals contemplate the elimination of fourth-section departures. The commission has found the suspended schedules not justified and has ordered them cancelled not later than Oct. 1, without prejudice to the filing of new schedules in accordance with the proposals made at the hearing and as outlined above.—I. C. C. Docket I. & S. 3,667.

Examiners' Reports

Plaster Retarder.—Examiner T. Leo Haden recommends an award of reparation on finding that the rates on plaster retarder, McCook, Ill., to Los Angeles and Long Beach, Cal., and Ludwig, Nev., were, are and for the future will be unreasonable to the extent that they exceeded, exceed or may exceed 80½ c., car-load minimum weight, 60,000 lb.—I. C. C. Docket No. 24,987, Standard Gypsum Co., Inc., *et al. v.* A. T. & S. F. *et al.*

Rate-Committee Dockets

New England Freight Assn.

Plaster.—It is proposed to amend Item 290-A of New Haven I. C. C. F-3,153, naming rates on plaster and plaster-board, to allow the same mixed car-load arrangement to points on the L. I. R. R. that apply generally in trunk-line territory.—Docket No. 26,-466.

Trunk-Line Assn.

Asbestos Waste.—Carriers propose to establish a rate on asbestos waste testing under 0-0-8-8 and over 0-0-5-11, car-load minimum weight 60,000 lb., from Black Lake, Coleraine, East Broughton and Tetford Mines, Que., to Jersey City, N. J., Norristown and York, Pa., of 37½ c. per 100 lb.—Docket No. 29,733.

Cement.—Shippers propose the publication of rates on cement, car-load minimum weight, 50,000 lb., from Oswego, N. Y., to N. Y. O. & W. Ry. and Unadilla Valley Ry. stations, based on 114 per cent. of I. C. C. Docket 12,710 scale.—Docket No. 29,-745.

Shippers at Oswego, N. Y., propose the establishment of rates on cement, car-load minimum weight 50,000 lb., to destinations in New York on the N. Y. C. and West Shore railroads, based on 114 per cent. of I. C. C. Docket No. 12,710 scale.—Docket No. 29,760.

Publication of a commodity rate of 19 c. per 100 lb., on cement from Brixment, N. Y., to Gauley, W. Va., is proposed by shippers. This reflects the I. C. C. Docket 12,710 scale.—Docket No. 29,762.

Lime.—Carriers propose the establishment of rates of 9½ c. per 100 lb. on building lime, car-load minimum weight 30,000 lb., and of 7½ c. per 100 lb. on agricultural, land, chemical, gas or glass lime, car-load minimum weight 30,000 lb., and ground limestone, car-load minimum weight 50,-000 lb., from Bainbridge, York Stations, Union Stone Co., Billmyer, Rheems Campbell, Wrightsville and Emigsville, Pa., to Williams and Germantown, Pa.—Docket No. 29,595, Sup. 1.

Central Freight Assn.

Crushed Stone.—Carriers propose to reduce the rate on crushed stone from Sandusky, O., to Willard, O., from 50 c. to 40 c. per net ton.—Docket No. 32,656.

Shippers propose a reduction in the rate on crushed stone from Keeport, Ind., to Paulding, O., from $1.50 to $1.10 per ton, to apply via Wabash, Cecil, O., C. N.—Docket No. 32,873.

Ground Limestone.—Carriers propose to establish the stopping-in-transit privilege on ground limestone, in bulk or in bags, at stations on the C. I. & L., for part unloading, at a stop-off charge of $6.30 per car.—Docket No. 32,654.

Gravel.—Shippers propose the establishment of a commodity rate on gravel from East St. Louis, Ill., and St. Louis, Mo., to Danville, Que., of $9.00 per net ton.—Docket No. 32,875.

Lime.—Carriers propose the establishment of the following commodity rates on lime from Milltown, Ind., to Madison, Wis., to alternate with each other: car-load minimum weight 30,-000 lb., 19 c. and car-load minimum weight 50,000 lb., 15 c. per 100 lb.—Docket No. 32,742.—They also propose from Milltown, Ind., to Wisconsin Dam, Wis., a rate of 25½ c., car-load minimum weight 30,000 lb., and a rate of 24 c., car-load minimum weight 60,000 lb.—Docket No. 32,746.

Shippers at Mosher and Ste. Genevieve, Mo., are asking for the establishment of rates on lime to destinations in C. F. A. territory and to points east of the Western Termini of Eastern Trunk Lines; (a) rates based on mileage scale prescribed in I. C. C. Docket 16,170, car-load minimum weight 30,000 lb.; (b) 80 per cent. of the rates in proposition (a) above to apply on a car-load minimum weight of 50,000 lb. At present the rates to C. F. A. territory on traffic routed via Kellogg, Ill., is 1 c. over the rate in effect from Alton, Ill., using the class rate that was in effect prior to Dec. 3, 1931. Rates to trunk-line territory are made on the Kellogg, Ill., combination, using a proportional commodity rate of 3½ c. to Kellogg, plus the rate beyond Kellogg.—Docket No. 32,790.

Shippers at Barberton, O., are asking for the establishment of rates on lime, car-load minimum weight 50,000 lb., to destinations in trunk-line and New England territories based on 80 per cent. of the rate applying on a minimum of 30,000 lb.—Docket No. 32,838.

Sand and Gravel.—A reduction in the rate on sand and gravel from Columbus, O., to Marion, O., via the Big 4, from 90 c. to 70 c. per net ton is sought by shippers.—Docket No. 32,657.

Reductions in the rates on sand and gravel,[1] from Warwick, O., sought by shippers are: to Mt. Vernon, O., from $1.20 to 95 c.; to Newcomerstown, O., from $1.10 to $1.00; and to Cambridge from $1.30 to $1.15 per net ton.—Docket No. 32,744.

A commodity rate on common sand and gravel,[1] from Ashtabula and Ashtabula Harbor, O., to Mather, Pa., of

$1.60 per ton is proposed by shippers. —Docket No. 32,832.

Slag.—Shippers of slag at Hamilton, O., are proposing establishment of a line of commodity rates to Louisville, Ky., and destinations in Indiana. Representative proposed rates are: to Louisville, Ky., 85 c.; to Woodford, Ind., 75 c.; to Decatur, Ind., $1.05; to Union City, Ind., $1.00; to Marion, Ind., $1.10; to Muncie, Ind., $1.05; to Kokomo, Ind., $1.10; and to Austin, Ind., $1.20 per net ton.—Docket No. 32,905.

Stone Dust.—A reduction in the rate on stone dust from Piqua, O., to South Bend, Ind., from $2.27 to $1.80 per net ton is proposed by shippers.—Docket No. 32,872.

Illinois Freight Assn.

Crushed or Ground Limestone.—A reduction in the rate on crushed, broken or ground limestone, from Mosher, Mo., to Freeport, Ill., from $2.28 to $2.05 per net ton is proposed. —Docket No. 6,761.

Sand and Gravel.—It is proposed to establish rates on river sand and gravel from Pacific, Jedburg and Yeatman, Mo., to Illinois points within a radius of 115 mi. from East St. Louis, Ill., based on the following mileage scale.—Docket No. 3,883-C.

Miles	Rate	Miles	Rate
10	$0.93	70	$1.28
20	.99	80	1.33
30	1.05	90	1.38
40	1.11	100	1.43
50	1.17	110	1.48
60	1.23		

Western Trunk Lines Committee

Agricultural Limestone.—The present rates on agricultural limestone in bags, barrels or in bulk,[1] from Louisville, Neb., to C. B. & Q. stations in Northwest Missouri and to Wabash stations in Missouri as far south as Conception, Mo., are the same as applicable on crushed stone, sand and gravel. Shippers propose the publication of rates on this commodity based on the following mileage scale which will result in reductions of from ½ c. to 3½ c. per ton.—Docket No. 496-T.

Miles	Rate	Miles	Rate
40	$0.59	150	$1.15
50	.63	160	1.19
60	.67	170	1.23
70	.71	175	1.25
80	.76	180	1.27
90	.82	190	1.31
100	.88	200	1.35
110	.96	210	1.38
115	.99	220	1.41
120	1.02	225	1.44
130	1.07	230	1.44
140	1.11	240	1.47
145	1.13	250	1.50

Southern Freight Assn.

Amiesite.—Shippers at Big Clifty, Ky., propose the establishment of rates on stone coated with asphalt, to points north of Ohio River, the same as now apply from Kosmosdale, Ky.—Docket No. 59,020.

Coarse Aggregates.—It is proposed to eliminate, for the account of the Birmingham & Southeastern R. R., the arbitrary applying in connection with that carrier on rates on crushed stone, sand, gravel and related articles, in Agent Speiden's Freight Tariff 388-A, I. C. C. 1,636.—Docket No. 58,962.

Talc.—It is proposed to reduce the rate on talc for export from Hemp, N. C., to Norfolk, Va., $3.38 to $2.15 per net ton, the car-load minimum weight to be 60,000 lb.—Docket No. 58,982.

Sand and Gravel.—Shippers at Elco, Ill., propose the publication of rates on sand and gravel to destinations in Kentucky and Tennessee, the same as applicable from Gravel Pit, Ill., in Agent Speiden's I. C. C. 1,635. —Docket No. 59,016.

Southwestern Freight Bureau

Lime.—Shippers at Springfield, Mo., are asking for the establishment of less-than-carload rates on lime to destinations in Iowa, Kansas, Missouri, Nebraska, Minnesota and South Dakota, the same as apply from Galloway, Mo.—Docket No. 25,466.

A cement manufacturer is seeking a rate on lime, car-load minimum weight 80,000 lb., from Sequiota, Springfield and Ash Grove, Mo., to Louisville, Neb. of 13 c. per 100 lb., to allow him to compete with mills located at other points in W. T. L. territory where lime is produced near the cement mills.—Docket No. 25,-532.

Plaster.—Shippers are asking that stopping-in-transit privileges on mixed-carload shipments of plaster and related articles be allowed. The present exceptions in Sec. 6, Item 155-5, Sup. 9, S. W. L. Tariff 173-C, restrict the privilege by excluding some of the commodities.—Docket No. 25,-521.

[1] The car-load minimum weight will be 90 per cent. of the marked capacity of the car, except that, when loaded to its full cubical or visible capacity, the actual weight will apply.

Index to Abstracts of I. C. C. Decisions

The following index is printed for ready reference to decisions of the Interstate Commerce Commission which have appeared in PIT AND QUARRY during the past six months. When the decision differs from the examiner's report, reference to the issue of PIT AND QUARRY in which the examiner's report is abstracted, is given following the abstract of the decision.

I. C. C. Docket No.	Date of Abstract
AGRICULTURAL LIMESTONE	
FSO 10,964	July 27
CEMENT	
24,316	Aug. 23
24,339	Apr. 6
24,728	July 13
I&S 3,649	May 18
I&S 3,736	Aug. 23
CEMENT BAGS	
24,724	May 4
CRUSHED STONE—SAND—GRAVEL	
23,315	June 29
23,315	Sept. 7
23,335	Apr. 20
24,099	July 13
24,099	Sept. 7
24,393	July 13
24,338	Aug. 10
24,394	Sept. 7
24,606	June 15
24,691	Aug. 23
24,618	Aug. 2[illegible]
24,710	June 1
I&S 3,642	Aug. 23
DRY BUILDING MORTAR	
FSO 10,992	Sept. 7
FLUXING STONE	
24,823	July 13
GROUND LIMESTONE	
19,943	Aug. 23
I&S 3,638	June 1
GYPSUM ROCK	
23,398	June 15
LIME	
16,170	June 15
19,951	June 15
19,957	June 15
20,234	June 15
24,456	Sept. 7
24,595	June 15
I&S 3,667	Sept. 21
MAGNESITE	
24,521	Apr. 20
PLASTER-BOARD	
23,155	Aug. 10
I&S 3,419	Aug. 10
I&S 3,446	Aug. 10
TALC	
24,435	June 29

Creates New Division to Sell and Service Pumps

Pettibone Mulliken Co. of Chicago, Ill., announces the creation of its Diamond pump division to sell and engineer direct to the trade its Diamond centrifugal pumps, traveling chain ladder cutters, and miscellaneous manganese and alloy-steel casting products. For many years the company has manufactured these products, under the registered trade name of Diamond, for use in the production of sand and gravel employing its own manganese and alloy-steel castings for the abrasion-resisting parts. These products, prior to June 14 of this year, were sold through other sales organizations.

The new division will maintain a closer contact between user and manufacturer and will maintain an engineering and designing service for complete sand-and-gravel dredging plants and equipment. J. W. Meckenstock has been made manager of the new division. Mr. Meckenstock has been connected with the company for the past five years. For several years past, he has spent his exclusive time selling and engineering Diamond products.

To Conduct Inspections of Cement Laboratories

The Cement Reference Laboratory, a joint project of the government and Committee C-1, American Society for Testing Materials, will at an early date start a third inspection tour among cement-testing laboratories. At present these field inspections are made without charge. Those laboratories which desire such inspection should address their requests therefor to the Cement Reference Laboratory at the Bureau of Standards.

All possible economy is necessary, and the itineraries of the inspectors will be planned so as to avoid needless travel. Through most localities an inspector will pass only once during the next two years, and, therefore, applications for inspections should be filed promptly.

Review of Foreign Practice

Observe Performance of Lepol Kiln Installation

Reports on practical experiences with the Lepol kiln have been slow in following the development of this apparatus because economic conditions have limited the number that have gone into use. Representatives of *Tonindustrie-Zeitung* have therefore recently gone to Spain and to Luxemburg to make observations on such kilns in operation, in the first case burning Portland cement and in Luxemburg burning iron-Portland.

The Lepol kiln is based on the invention of Dr. O. Lellep of an original method for utilizing the excess heat from a rotary kiln and improving its thermal efficiency. A traveling grate is installed behind the kiln. This grate carries a layer of cement raw mix toward the feed end of the kiln, and the hot gases from the kiln travel over the grate in counter-current and, to insure maximum contact, are sucked down through the grate and its load of material. The raw-cement feed must be suitably prepared to effect the heat exchange as efficiently as possible, and Dr. Lellep's invention included the addition of water to the dry cement mix and the formation of small balls or lumps which, because of their minimum contact with one another and their maximum exposure of surface, do effect this transfer efficiently. Actually, the lumps lie on the grate in a layer 15 to 20 cm. (6 to 8 in.) thick, and their water content is 12 to 14 per cent., yet the transfer of heat is so effective that the temperature of the gas drops from over 900 deg. C. above the material to around 150 deg. below the grate, while the material reaches the kiln already in large measure decarbonated.

The advantages of such a process are: (1) Gases from the rotary kiln reach the flue at the minimum of excess temperature; (2) the dust contained in the discharged gas, and therefore lost from the cement feed, is practically nil, as the bottom layers of material are cooler and still contain some moisture, thereby extracting the dust from the gas in the manner of an absorption filter; (3) the balls or lumps formed for the grate retain their form during the burning, and the vaporization of their water leaves them porous in structure, so that they are in especially good condition for grinding; (4) the construction and operation of the kiln itself are greatly simplified, for the gigantic kilns of 100 m. or more in length can be replaced by kilns 25 to 30 m. long; this naturally means a greatly lowered loss of heat by radiation. At the same time, there is no unfavorable condition added by the requirement of the traveling grate, for the gases cross the grate at such reduced temperatures that the thermal demands on them are not great.

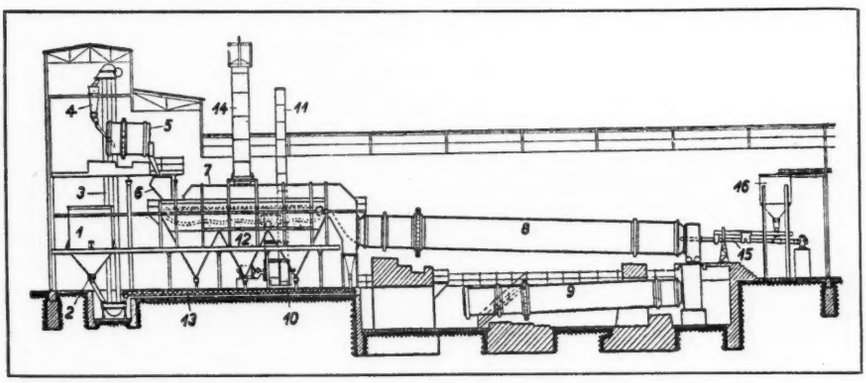
A kiln installation of this type is shown in the accompanying drawing. The raw feed is delivered from a bin (1) by a screw (2) and a bucket-elevator (3) to a small feed-bin (4). From here the material is fed, and at the same time sprinkled with water, into a drum (5), which is rotated to form the raw mix into lumps. These are then collected in a bin (6) which feeds the traveling grate (7) inclosed in a chamber. The material then travels slowly to the kiln (8) and finally passes through the cooler (9). The hot gases pass through these machines in counter-current, being sucked through the grate by means of a fan (10) and finally passing to the stack (11). Particles falling through the grate are collected in hoppers (12) and returned by screw-conveyors (13) to the elevator. An auxiliary chimney (14) is used only in putting the installation into operation.

At the San Sebastian installation in Spain the authors made a detailed study, Oct. 23, 1931, covering a period of 24 hr. The production of clinker in that period was 238.464 metric tons, or 9.936 tons per hr.; this amounts to 61 kg. per hr. and 1.46 tons for the 24 hr. per cu. m. of kiln content. In the same period the plant burned 28.56 tons of coal, a mixture of fat and lean Spanish coals with a minimum (for the mix) value of 7,147 cal. per kg. Deduction for moisture leaves a consumption of 28.389 tons of dry coal, a ratio of 11.9 per cent. to the clinker output. The heat consumption per 100 kg. of clinker was calculated thus at 85,850 cal.

The raw mix was prepared for a standard Portland cement from three stones quarried. It was ground to 0.4 to 0.8 per cent. on the 900 and 10.2 to 12 per cent. on the 4,900-mesh-per-sq. cm. screen. It was sprinkled with 12 per cent. of water. The lumps prepared for burning ran in size as follows: No. 50 sieve, 0.1 per cent.; No. 30, 0.3 per cent.; No. 16, 3 per cent.; No. 8, 19.9 per cent.; No. 4, 47.7 per cent.; No. 3, 24.9 per cent.; and No. 2 sieve, 4.4 per cent. These were spread on the grate in a layer 17 cm. thick, advancing at the rate of 30.48 m. per hr. It was calculated that probably approximately 20 per cent. of the material had been decarbonated by the time at which it reached the kiln. The clinker produced was excellent in appearance and uniformity; it contained no free lime, and no trace of under- or overburning was observed. The cement resulting from grinding resisted the soundness tests according to the German specifications, and yielded strengths of 32.3 kg. per sq. cm. in tension and 362 kg. in compression at 2 days to 50.8 kg. and 637 kg. respectively at 28 days (combined storage) in standard mortar tests.

The power consumption is 18.5 kw. for the granulating drum, 3.5 kw. for the grate, 20 kw. for the rotary kiln, 12 kw. for the rotary cooler, 13.5 kw. for the high-pressure fan, and 42 kw. for the discharge fan, which reduces to 11 kw.-hr. per ton of clinker produced. This off hand is an unfavorable comparison with 8.9 kw.-hr. for an ordinary rotary kiln outfit (including feeding screw, kiln, cooler and fan), but the difference is more than offset by the lower power requirements for grinding coal, the latter amounting in the case of the Lepol installation to 4.4 kw.hr. per ton of clinker and in the case of the rotary kiln of unusual type to 7.2 kw.-hr. per ton of clinker.

A later report will analyze similar observations at the iron-Portland cement plant at Esch, Luxemburg, only a few general facts about this installation being presented here.—Prof. Dr. W. Eitel, Direktor Alfred Müller and Dr. K. A. Goslich in *Tonindustrie-Zeitung* 56:679-684, July 4, 1932.



Sketch of a typical Lepol kiln installation.

Recent Patents

AMERICAN

Concrete

Truck mixer. Joseph Eggert, Columbus, O., assignor to Jaeger Machine Co., same place. No. 1,872,624.

Crushing and Grinding

Combination hammer and cutter for hammer mills. Charles D. Ammon, Lincoln, Neb. No. 1,871,489.

Grinding mill. Harlowe Hardinge, York, Pa., assignor to Hardinge Co., same place. No. 1,872,036.

Hammer crusher. George W. Borton, New Lisbon, N. J., assignor to Pennsylvania Crusher Co., Philadelphia, Pa. No. 1,872,233.

Yielding release for crusher bowls. Edgar B. Symons, Hollywood, Cal., assignor to Nordberg Mfg. Co., Milwaukee, Wis. No. 1,873,671.

Drilling

Drilling mechanism. Frederick W. Vodoz, Wilmette, Ill., assignor to Goodman Mfg. Co., Chicago, Ill. No. 1,871,638.

Drill-tool retainer. George Rauberstrauch, Cleveland, O., assignor to Cleveland Rock Drill Co., same place.

Excavating

Excavating machine. Charles H. Lotte, Massillon, O., assignor to Byers Machine Co., Ravenna, O. No. 1,871,539.

Excavating machine. Asger Eilersgaard, Chicago, Ill., assignor to Link-Belt Co., same place. No. 1,872,129.

Combined digging-lip and dipper-tooth. Werner Lehman, Milwaukee, Wis., assignor to Bucyrus-Erie Co., South Milwaukee, Wis. No. 1,872,307.

Digging element for excavating machines. Donald H. Young, Berkeley, Cal., assignor to American Manganese Steel Co., Chicago, Ill. No. 1,872,865.

Bucket-lip extension. Donald H. Young, assignor to American Manganese Steel Co. No. 1,872,866.

Lime

Method of producing hydrated lime. Charles W. Keller, Bellefonte, Pa., assignor to American Lime & Stone Co., same place. No. 1,871,530.

Preparation of high-plastic lime. Max Y. Seaton, Palo Alto, Cal., assignor to California Chemical Corp., Newark, Cal. No. 1,872,512.

Materials Handling

Skip hoist. Percival K. Reed, Llanerch, Pa., assignor to Atlas Conveyor Co., Philadelphia, Pa. No. 1,871,559.

Cement-loading device. George O. Harm, Warren, O., assignor to Stevens Metal Products Co., Niles, O. No. 1,872,283.

Integral mining locomotive. Claude Bethel, Wilkinsburg, Pa., assignor to Westinghouse Electric & Mfg. Co. No. 1,872,875.

Grab bucket and skip hoist. Charles C. Hormel, Denver, Colo., assignor to Allen-Sherman-Hoff Co. No. 1,873,764.

Washing

Gravel-washing machine. Edgehill T. Burnside, Shelbyville, Ind. No. 1,871,583.

Mechanical sand-washer. Richard Clanton, North Hollywood, Cal. No. 1,872,892.

FOREIGN

Blasting and Explosives

Apparatus for controlling shot-firing in mines. J. Davis & Son (Derby), Ltd., and J. C. Dawson. British 377,359.

Explosives. Canadian Industries, Ltd., Montreal, Que., assignee of Benjamin A. Gillie, Ashland, Wis. Canadian 324,730 and 324,731.

Blasting explosive. Atlas Powder Co., Wilmington, Del., assignee of Carl D. Pratt, Tamaqua, Pa. Canadian 324,940.

Cement

Production of cement mixes. I. G. Farbenindustrie Akt.-Ges. German 555,893.

Process for thickening slurry, particularly raw cement slurry. Fried. Krupp Grusonwerk Akt.-Ges., Magdeburg-Buckau. German 555,895, addition to 530,640.

Handling of sintered and ground cement or similar binder. Mecanique Moderne & Anker Reunis, Nancy, France. German 556,785.

Burning slurry materials, particularly raw cement slurry. N. Polgar, Vienna, Austria. German 557,225, addition to 534,079.

Water-setting cements. W. Singleton. British 377,202.

Production of cement containing arsenious oxide. Otto Stalhane, Donovan R. E. Werner and Stig Giertz-Hedström, Stockholm, Sweden. Canadian 325,069.

Cement mixture containing arsenious oxide and common cement. Otto Stalhane, Stockholm, Sweden. Canadian 325,116.

Processing of cement and mortar. Chemische Fabrik Grünau, Landshoff & Meyer Akt.-Ges., assignee of Walter Kirchner, Berlin-Grünau, Germany. Canadian 325,141.

PIT AND QUARRY *will furnish, at its actual cost, a copy of any patent cited here. A charge of ten cents per copy is made by the U. S. Patent Office, Washington, D. C., and readers may procure a copy directly by addressing the Commissioner of Patents, with payment for copies requested. Postage stamps are not accepted by the Patent Office. We will endeavor to obtain copies of foreign patents for our readers but we cannot give assurance in every case for the reason that copies of such patents are not printed for distribution as liberally as are the American copies, nor is there a fixed charge per copy.*

Concrete

Preparatory treatment of silica-bearing mineral particles for aggregates in hydraulic or bituminous mortars and concretes. G. Wieland, Berlin-Zehlendorf. German 556,256.

Process and apparatus for handling concrete and similar materials. Clinton Motors Corp., Reading, Pa. German 555,673.

Manufacture of concrete blocks and the like. Universal Rubber Paviors, Ltd., L. Gaisman and A. F. Sexton. British 377,269.

Concrete surface-reinforcement. John Douglas Scott and Percy William Powley, London, England. Canadian 324,872.

Crushing and Grinding

Apparatus for grinding coal and other solid materials. E. Feuerheerd and T. H. Henderson. British 376,760.

Grinding mills. C. H. Crago. British 377,008.

Stone-breaking and like machines. J. H. Mason. British 377,052.

Roller-grinding mills. Miag Muhlenbau-und Industrie Akt.-Ges. British 377,616.

Grinding mill. F. L. Smidth & Co., assignee of Michael Treschow, New York, N. Y. Canadian 324,817.

Pulverizing machine. Peter V. Jali, Portland, Ore. Canadian 325,100.

Roller-grinding machine. Ottawa Steel Products, Inc., assignee of Harry J. Swanson, Grand Haven, Mich. Canadian 325,179.

Drilling

Fluid-operated feeding-means for rock-drills and other tools. P. M. Holman, K. J. Holman and B. Cook. British 376,938.

Drill. Canadian Atlas Steels, Ltd., Welland, Ont., assignee of Harry C. Norley, North Bay, Ont. Canadian 324,945.

Drying

Drying installations. Metallgesellschaft Akt.-Ges., Frankfurt a. M., Germany. German 554,004.

Feeding rotary driers. I. G. Farbenindustrie Akt.-Ges. German 556,447.

Gypsum

Treatment of calcined gypsum. Societe Lambert Freres & Cie., Paris, France. German 553,519.

Plasterboard. Canadian Gypsum Co., Ltd., Toronto, Ont., assignee of George D. King and James S. Offutt, Chicago, Ill. Canadian 324,952.

Kilns

Electrically-fired shaft or chamber kilns for burning natural carbonates and similar materials. G. Blume, Munich, Germany. German 554,292.

Uniform firing of tunnel kilns. C. Pfaul, Dresden. German 556,723.

Materials-Handling

Jigging conveyors. T. B. Wilkinson. British 376,782.

Feed-apparatus for conveying material from weighing and like machines to packeting and like machines. V. D. Popov. British 376,979.

Manufacturers' Publications

Copies of any of these publications may be had by writing the manufacturers who publish them. Please mention PIT AND QUARRY *when writing.*

Cement-Mill Equipment

Omico and Manganoid Metals. 4 p. (Folder No. 548. The Jeffrey Mfg. Co., Columbus, O.) Describes and illustrates grinding balls, mill and chute liners, screen plates, elevator buckets and bolts for cement-mill service. This equipment, made of special alloys of exceptional hardness and toughness, is guaranteed to give much longer life than ordinary metals.

Materials Handling

Koehring Dumptor. 16 p. (National Equipment Corp., Milwaukee, Wis.) Describes and illustrates a heavy-duty dirt-moving unit mounted on crawlers or wheels. Hailed as a versatile machine for its ability to do a number of tasks with astounding agility, it is driven by twin gasoline engines.

"Operations of the Central Kansas Quarries Co." 2 p. (The *P & H Crowd,* Vol. 7, No. 2. Harnischfeger Corp., Milwaukee, Wis.) Describes and illustrates the part played by the shovels made by this concern in quarrying stone at the operations of the Central Kansas Quarries Co., near Ottawa, Kan.

Portable Fuller-Kinyon Systems for Bulk Cement. (The Fuller Co., Catasauqua, Pa.) A new loose-leaf catalogue particularly intended to illustrate simplified mixing-and batching-plant design with reference to the unloading, handling and storage of both cement and aggregates. It covers central-mixing plants, general construction and highway-contractors' plants and floating mixing plants. Various methods of unloading railway cars and barges are shown, together with the use of the same system for conveying cement to and from warehouse storage.

Mixers, Truck

The New Leach Truck Mixer. Folder. (The Leach Co., Oshkosh, Wis.) Describes and illustrates an advanced type of truck mixer built in 1-, 2-, and 3-cu.yd. capacities. The smaller model is mounted on a Ford chassis.

Pumps

High-Pressure Hydraulic Pumps. 12 p. (Bull. No. 36. Baldwin-Southwark Corp., Philadelphia, Pa.) Describes and illustrates a line of high-pressure hydraulic pumps, both horizontal and vertical. Tables of dimensions and capacities are included. A feature is a description of the new hydro-gas accumulator hydraulic-power system, which retains conveniences of the weighted accumulator plus several advantages of its own.

Screens, Vibrating

Lippman Vibrating Screens. 8 p. (Lippman Engineering Works, Milwaukee, Wis.) Describes what is heralded as the "simplest vibrating screen" and illustrates the various types as well as applications in the field. Supplied in single-, double-, and triple-deck models. Built-in electric motors, gasoline engines or countershaft drives are provided.

Speed Reducers

Hygrade Worm Gear Speed Reducers (Cat. No. 302. Foote Bros. Gear & Machine Co., Chicago, Ill.) A new edition of a complete catalogue on speed reducers. Due to new hob equipment, the ratios and ratings have been revised for many of the different sized units. The new leak-proof vertical models, a recent development of the company, are shown.

Wire Rope

Take This Tip from Mr. Flex Set. Folder. (Broderick & Bascom Rope Co., St. Louis, Mo.) A mailing piece which describes and illustrates in graphic style five of the important advantages of the preformed wire rope made by this concern. Elimination of internal stress is explained in a simple and convincing manner.

Pumpings from the Old Pit

Fifteen Years Ago

THE Walsh Sand & Gravel Co. of Burlington, Wis., opened a new deposit of silica sand near Kilbourne, Wis.

* * *

Gov. Bilbo of the state of Mississippi announced that plans were being made to erect two limestone plants to supply agricultural stone at cost to Mississippi farmers.

* * *

Ten Years Ago

FIRE destroyed the Brixment plant of the Louisville Cement Co. at Speed, Ind., with damage estimated at $100,000.

* * *

C. S. Rodgers of Bucyrus, O., formed the Buck Hill Washed Sand Co. and announced that plans were in progress for the erection of a modern plant to cost $50,000.

* * *

The railway-car shortage was still seriously hampering the movement of materials. Producers throughout the country were feeling the effects of this handicap, the middle-west being hardest hit.

* * *

R. M. Bates, vice-president of the Bates Valve Bag Co., Chicago, left for London, England, to take charge of the company's office there.

Announcement was made of a change in name of the Lake Weir Washed Stone Co., of Jacksonville, Fla., to the Ocala Limerock Co. The personnel remained the same.

* * *

Five Years Ago

THE Pioneer Sand & Gravel Co. of Seattle, Wash,, began the preparation and distribution of ready-mixed concrete. Bathtub-type truck bodies were used to transport the material to the job.

* * *

What was said to be the deepest gypsum mine in existence was opened by the United States Gypsum Co. at Plasterco, Va. The shaft descended 560 ft.

* * *

The Portland Cement Assn. became a member of the American Engineering Standards Committee. F. W. Kelley, head of the North American Cement Corp. served as the direct representative.

Saving Through Safety

Eye Accidents Continue As Outstanding Hazard in Pit and Quarry Work

By LEWIS H. CARRIS
Managing Director,
National Society for the Prevention of Blindness

Since the beginning of the twentieth century we have been making steady progress in the prevention of blindness and in the conservation of vision. Nearly all the major eye diseases are under control by the ophthalmologists; school children with seriously defective vision are provided with special "sight-saving" glasses by the educators; and proper lighting has been the contribution of the illuminating engineers. But this picture of progress is marred by the figure of a workman, in great pain, shouting: "Oh! It struck me in the eye!" For, the eye accidents of industry have come to be one of the most serious causes of blindness in America. There is, in fact, considerable ground for the belief that each year more persons in the productive years of their lives are permanently robbed of their sight by occupational hazards than by any other single cause of blindness.

Lewis H. Carris.

Particularly dangerous are the quarry and allied industries—cement, lime, gypsum, crushed-stone, sand-and-gravel. The danger of injury to the eye from flying objects exists to some extent in practically every industry, but it is almost constantly present in the quarrying and related fields. When it is impossible in any particular operation to eliminate this hazard by changing the machine, the tool, or the method of work, protection must be sought through the use of goggles, masks or screens, depending on local conditions, often through the combination of these three media.

In the quarry industry accident-prevention work is carried on by such trade organizations as the National Crushed Stone Assn., the National Lime Assn., the National Sand and Gravel Assn., and the Portland Cement Assn., in addition to the activities of the United States Bureau of Mines, the National Safety Council, the National Bureau of Casualty and Surety Underwriters, and the National Society for the Prevention of Blindness. As in industry generally, quarry men have found that, aside from humanitarian considerations, accident prevention "pays in dollars and cents."

This viewpoint was well expressed by John Prince, president of the Stewart Sand & Material Co., of Kansas City, Mo., in an address before the Quarry Section at the Twentieth Annual Safety Congress in Chicago last year. Mr. Prince said: "Most executives have first become conscious of the need for safety through the money cost of accidents. The executives of a very large percentage of the smaller industries of the country, including probably all of the quarry industry, have come to realize the need for safety work of some kind within the last few years, practically all within the last ten years. I believe the quarry section of the National Safety Council has been organized for six years. This rather recent awareness of safety on the part of these executives has undoubtedly come about through the increasing cost of industrial accidents. Before compensation laws were passed in many of our states, the employers' liability rates in this industry were relatively low, and the insurance companies carried the money cost of accidents without seriously disturbing the peacefulness of the management.

"As society became increasingly aware of the over-all costs of industrial accidents, industry was forced through compensation laws to pay an increasing percentage of this cost, with the result that the budget item for compensation insurance became larger and larger, until management began to consider what could be done about it. While most insurance policies carried certain provisions whereby the premium would be increased or decreased as a result of the individual record made by the insured, still these credits did not represent the full amount which many executives believed could be cut from their accident cost as the result of a good record in the reduction of accidents. Among a considerable number of companies in several states, self-insurance began to be tried. When this has once been started by a company, the executive sees the rather large money rewards which come through the reduction of accidents, or the penalty for an increase in accidents. Right then the safety director becomes an important member of the executive staff, whose results can apparently be measured very accurately in dollars and cents.

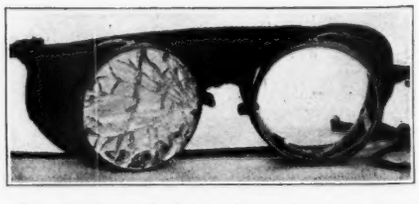
"From this point on I believe the thorough executive will begin to see a broadening picture and realize that safety work is not, in fact, a separate activity, but one which is very much tied in with other questions of great importance, such as the average cost of production and the ultimate profits of the operation. From my own experience I believe the employee who is really 'sold' on the importance of safety will sometimes have a broader point of view on the subject than is held by the executive. Too often the executive is thinking principally of the money cost of accidents."

At the same meeting of the Quarry Section, however, an insurance authority pointed out this fact: "Any attempt to convince workmen that an accident-prevention program is in progress will be a flat failure unless they are made to realize that the executives and their superintendents or foremen are sincere beyond the monetary value of the undertaking." He emphasized the fact that rates for compensation insurance on quarry operations are unnecessarily high because so many hazards are permitted. Advocating the use of goggles by all quarry workmen, this insurance expert remarked that "many an eye has been lost in starting holes in solid rock, breaking chunks and picking in frost."

The United States Bureau of Mines has devised a measurement for five classes of accidents. Each class has a scale of "days lost," for the purpose of determining severity rates, as follows:

6 000	lost days for a death
6,000	lost days for a permanent total disability
800	lost days for a permanent partial disability
30	lost days for a disability over 14 days
4	lost days for a slight disability of from 1 to 14 days.

Reporting to the American Engineering Council in 1928, and basing


Lens badly cracked but the workman's eye was saved.

its conclusions on statistics from 1,660 companies in the quarry industry with a total of 94,242 employees, the Bureau of Mines said: "The quarry industry from 1916 to 1924 made but slight improvement in either its production or accident performance. The fatality rate of the industry and most of its subdivisions definitely declined during the period. The number of less-serious accidents increased. The limestone group, the largest subdivision of the industry, experienced a decrease in the rate of production, an increase in the accident-frequency rate, and virtually a constant accident-fatality rate. The small groups — granite, sandstone, bluestone, slate, and marble—show such wide fluctuations in production and accident rates that no definite tendencies are apparent."

Examining the detailed statistics for the last year (1924) in this report, we find 138 deaths and a total of 14,915 lost-time accidents. Dr. Louis Schwartz, senior surgeon of the United States Public Health Service, recently estimated that "at least 10 per cent. of all industrial accidents are eye cases." On this basis, approximately 1,500 men suffered eye injuries in the quarry industry in a single year.

Naturally, the direct and indirect cost of these eye accidents was tremendous; it is a difficult matter to estimate the many thousands of dollars that are lost to the quarry industry annually from this source. The great tragedy of this waste in eyesight, and money rests in the fact that it is mostly preventable. An analysis of the circumstances surrounding 75,000 accidents has led H. W. Heinrich of the Travelers' Insurance Co. to the conclusion that 98 per cent. of all industrial accidents are preventable, and, of these, 88 per cent. could be prevented by proper supervision and administration.

There is ground, nevertheless, for a feeling of optimism. The business depression—which has brought so many bad things with it—has brought one good thing, at least, in the form of greater safety achievements, according to W. W. Adams, chief statistician, Demographical Division, United States Bureau of Mines. At last year's National Safety Congress, Mr. Adams said to the Quarry Section: "Nineteen-thirty was a good year for the quarry industry so far as the prevention of accidents is concerned. In fact, it was the best year that the industry has ever experienced. Only once before has the death rate been as low as it was last year, and the rate for non-fatal injuries was the lowest since complete records of injuries have become available.

"The marked reduction in the accident rate last year is notable because of the conditions under which it was accomplished. Safety often suffers a set-back during times of irregular employment or part-time operation, a condition that prevailed so widely in 1930. When such conditions prevail, the *morâle* of the employees is lowered, the men worry over inadequate or uncertain income, and often both men and management pay less attention to good-housekeeping from a safety point of view. These factors often lead to an increase in the accident rate among employees, yet in 1930 we find an entirely different result. Accidents were not only fewer in numbers than in the preceding year but the frequency rate per 1,000 300-day workers was also lower than in 1929.

"It is probable that the conditions from which quarrying and other industries suffered last year had the effect of weeding out many accident-prone employees and those otherwise inefficient, and of retaining on the pay-roll, for such work as was available, the more efficient workers. As efficient workers are usually the safest workers, this seems to me to be the most probable cause of much of the progress in safety made under the unusual conditions that prevailed in 1930."

Injured—but goggles saved his eyesight!

In Pennsylvania the quarry industry has learned very definitely that "safety pays." During 1928 a statewide accident-prevention campaign was sponsored by the Pennsylvania Dept. of Labor and Industry. One of the results of this campaign was the reduction in the number of eyes lost in Pennsylvania's industries from 588 in 1927 to 521 in 1928—a reduction of 67 or 11.4 per cent. The cost of compensating eye injuries in Pennsylvania amounts to approximately $820,000 annually. Moreover, it has been said that the indirect loss to industry of accidents generally is four times as great as the direct loss, namely, compensation payments. These figures concerning one state suggest the enormous waste of eyes and money that needs to be checked in the nation.

"The economic incentive to quarry safety work in Pennsylvania is impressive," declares Thomas J. Quigley, chief of the Mines and Quarry Section, Pennsylvania Dept. of Labor and Industry. "The efforts already put forth have resulted in lower quarry rates for compensation insurance in this state than in any other state, notwithstanding the fact that Pennsylvania is the largest producer. Pennsylvania's quarry insurance rate at this time is $3.60 per $100 of pay-roll. For Alabama it is $4.77; Indiana, $5.32; Illinois, $6.57; Kansas, $7.44; Georgia, $7.76; Maryland, $7.99; and New York, $9.87. Only through accident-prevention activity can this comparatively low insurance rate in Pennsylvania be maintained."

If there are still left among quarry men any skeptics on the subject of safety work, let them investigate the 1928 Pennsylvania safety-campaign records. Nine quarries, entering the contest conducted by the United States Bureau of Mines, finished the year without a lost-time accident. Four cement plants in Pennsylvania won trophies awarded by the Portland Cement Assn. for operating an entire year without a lost-time accident. The White Haven quarry of the General Crushed Stone Co. won the National Crushed Stone Assn. trophy for the best quarry record. Among the plants which did not enter the safety contest officially, the Pennsylvania-Dixie Cement Corp., Dexter No. 4 quarry, completed three years without a lost-time accident. Such records are evidence of what a quarry can achieve in the way of accident prevention.

A mandatory rule that every employee must wear his goggles at all times while working is one of the best methods devised so far to compel men to guard their eyes. The Pullman Co., which employs thousands of laborers and mechanics in its various shops, has found this rule unusually successful. Harry Guilbert, who is responsible for its success, remarked to me recently:

"Mr. Carris, in my experience as safety director of the Pullman Co. I have employed every possible method to induce men to protect their sight. I have posted bulletins picturing men whose goggles were broken by flying missiles, but whose eyes were saved. I have distributed pictures of men wearing goggles spattered with molten metal, but with sound eyes. I have scattered promiscuously horrible examples of carelessness in the form of enucleated eyes preserved in bottles of alcohol and pictures of children leading blind fathers about the streets. I have shown pictures of men with scarred cheeks and foreheads, the result of missiles deflected by goggles. Rules and regulations were promulgated and posted everywhere with no apparent results. However, the president's mandatory rule that every employee, irrespective of his occupation,

(*Continued on page 53*)

New Machinery and Supplies

Cars Weighed While in Motion by New Machine

A monthly saving of from $11 to $1,400, depending upon the hourly cost of an engine and crew and whether the number of cars weighed is 10 or 100, is claimed by the Streeter-Amet Co., of Chicago, makers of an automatic weight recorder which registers the weight of each loaded railway car while in motion, as against hand-weighing, when it is necessary to spot, cut, hand-weigh and remove a car from the ordinary scale.

The Streeter-Amet recorder is made in two types, one with a capacity up to 250,000 lb.—the other having a maximum capacity of 400,000 lb.

The recorder is being placed in a number of plants on a rental basis. This rental, the company claims, is far less than the savings possible when cars are to be weighed. Even when but 10 cars are weighed daily, figuring the hourly cost of the crew at the minimum of $8.00, the monthly saving is computed as $11.70—after the cost of rental has been deducted.

Complete information regarding the recorder and the plan may be had by writing the company, whose offices are at 4101 Ravenswood Ave., Chicago.

Truck Hauls New Power Shovel from Job to Job

The Bear Cat Jr., a new ⅜-cu.yd. convertible shovel, which is light enough to mount and transport on a heavy-duty motor truck, is announced by The Bearcat Shovel Works, a division of The Byers Machine Co., Ravenna, O.

It sells for considerably less than any other shovel in the Byers' line, and is the result of this company's 50 years of experience in building excavating and material handling equipment.

The Bear Cat Jr. weighs 6½ tons complete as a shovel. This light total weight is practical chiefly because of the balance of machinery which eliminates all dead counterweight, its extremely simple construction which allows all parts to be amply rugged, and its freedom from crawler mechanism beneath the machinery deck.

All operations of traveling, steering from both crawlers, swinging, independent crowding and hoisting are accomplished through only three operating shaft assemblies on the fully-enclosed machinery deck. Even the travel shaft is located on the machinery deck; there are no shafts below the main frame. A 3-speed transmission between the motor and take-off gear provides three travel speeds and two operating speeds, for ordinary or light digging. The gear-driven swinger can be positively locked to prevent swinging while traveling. All machinery is protected by an automobile type of hood enclosure and motor hood can be locked to prevent theft of gasoline and accessories. The motor is a 4 cylinder slow-speed industrial type developing 30 h.p. It uses only 10 gal. of gasoline per day in steady digging.

The light-weight shovel being carried by truck.

New Lubricating Element Protects Metal Surfaces

A revolutionary new lubricating process, developed by W. V. Kidder, a combustion engine expert of La Crosse, Wis., which is said to afford not only vastly increased protection to the most vital parts of an internal-combustion engine, but, as well, far greater operating efficiency and economy for new car or old, is at present creating widespread comment.

The name of this product is Pyroil, an oil product embodying a specialized, heat-proof element. This product is simply added in small quantity to regular lubricants and to the gasoline, or used in a top oiler. It then deposits its heat-proof element on all bearing and frictional surfaces, actually penetrating the metal, filling pores, scorings, etc., and creating a slippery, glossy surface which in itself is self-lubricating. Once created, and sustained, this surface, it is said, is impervious to any degree of motor heat, to wear or to wet-gas dilution. This surface perpetually renews itself yet never becomes thicker than a mere film and cannot interfere with clearances in any way. In spite of this it is sufficient to protect metal from wearing and damage when oil thins or the metal is otherwise left unprotected.

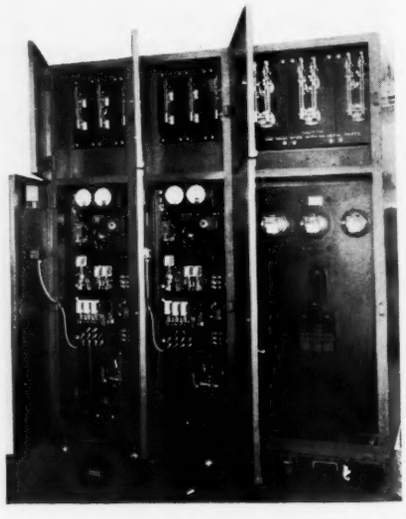
In the heat-ridden motor head, Pyroil renders permanent lubrication to valves, stems, guides, upper cylinder walls and pistons. Friction, overheating, noise and vibration are greatly reduced, power increased and a considerable saving in gas and oil consumption is effected. In the crankcase, Pyroil renders a similar service.

Pyroil has been subjected to the severest of tests by many recognized authorities in the automotive field with such successful results that one unfamiliar with its merits is amazed. However, the Pyroil Co. guarantees that all claims made are backed by proof on file in the home office.

As a test of the efficiency of the Pyroil surface deposited on the metal, cars treated with Pyroil have been officially driven 745 miles, 318.7 miles, 208.6 miles and 161 miles with no oil whatever in the crankcase. All these "dry" runs were conducted under affidavit. Further interesting details of this product may be obtained direct from the Pyroil Co. at La Crosse, Wis.

New Starter for Motors Is Protected from Dust

A synchronous motor starter, entirely inclosed in cubicles for protection against dust, was recently built and shipped from the East Pittsburgh Works of the Westinghouse Electric



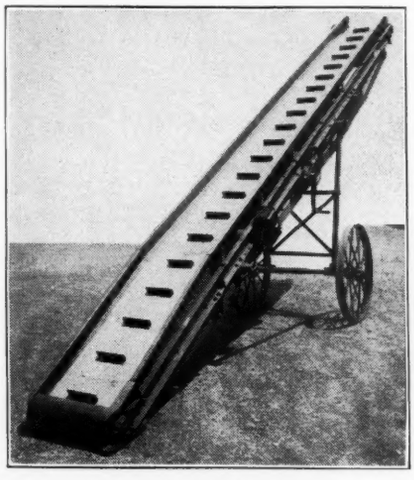
Cubicle starter with compartments open.

& Manufacturing Company. In it are three compartments. One contains an incoming line circuit breaker with disconnect switches, while each of the others houses an individual synchronous motor starter with an electrically-operated breaker and an individual disconnect switch.

Each compartment is provided with a lock to prevent unauthorized attention, and no operation can take place from without the cubicle except starting and stopping the motors, which is accomplished from a remote push button station. The individual motor generator exciters are controlled from the same push button that starts the synchronous motor.

Portable Conveyor Has Numerous Improvements

A new portable belt conveyor, embodying numerous improvements over last year's model, is announced by Link-Belt Co., Philadelphia. Among other features, it incorporates fixed steel retaining sides extending the entire length of the conveyor, thus preventing lumps from spilling over the sides of the belt at any point.



An improved portable conveyor.

To obviate a common source of trouble experienced with portable belt conveyors of this general type, the foot end has been improved to keep material away from the return run of the conveyor belt. Another feature is the new arrangement of the foot end plate, permitting the convenient use of the machine without this plate, when desired, minimizing labor in feeding, and serving to speed up loading.

The conveyor is on 21 ft. centers and either 18- or 24-in. belting can be supplied. All shaft bearings are bronze-bushed. Alemite force-feed lubrication is provided.

The General Refractories Co., Philadelphia, Pa., announces that arrangements have been concluded with McLeod & Henry Co., Troy, N. Y., whereby it is now in position to offer to the trade the well known Carbex (silicon carbide) commodities manufactured by the McLeod & Henry Co.

Incorporations

CONCRETE MATERIALS CORP., Cincinnati, O. 3,000 shares n.p.v. and $1,000 preferred stock. J. G. Williams, Fred Weiland and Harry P. D'Angelo.

NORTHWESTERN DREDGING CO., Sturgeon Bay, Wis. Capital $35,000. Thomas A. Sanderson, Grover M. Stapleton and John H. Purves.

KIRKWOOD SAND & GRAVEL CO., Kirkwood, Mo. Olive Eckstein and others.

INDEPENDENT CRUSHED STONE CO., Omaha, Neb. Capital $20,000. Jean Thom and Albert E. May.

GREENE COUNTY CRUSHED STONE CO., Inc., Catskill, N. Y. 100 shares common n.p.v. William S. Brill and Marion A. Benley, both of White Plains, and Agnes B. Grogan of Mount Vernon, N. Y.

SOUTHERN GRAVEL & SAND CO., McRae, Ga. Capital $20,000. W. W. Simmons, McRae, Ga., Herbert McRanie and E. C. Hosford of Eastman, Ga.

ROCK ASPHALT CO. OF UTAH, Dooly Bldg., Salt Lake City, Utah. Capital $100,000. Howard C. Means, president, general manager; Arthur N. Smith, Price, Utah, vice-president; Mrs. Viola DeHon, secretary-treasurer.

Eye Accidents (From page 51)

must wear goggles while on duty, and that visitors while passing through the plant must do likewise, brought order out of chaos and a record unsurpassed—six years without an eye loss."

In the quarry industry, too, the use of goggles has saved innumerable eyes. Not long ago the National Society for the Prevention of Blindness and the National Safety Council set out to discover the total number of authenticated cases of workmen's eyes saved from serious injury or destruction through the use of goggles or headmasks in American industry. The study revealed that more than 10,000 eyes and at least $46,000,000 were saved in a period of two years among 583 plants, employing a total of 500,000 workmen. As these figures included only corporations with definite records, there can be only conjecture as to the number of eyes actually saved by protective devices in all American industry. Classified under "mining, quarrying and smelting," the records of this study show that 86 workmen were saved from serious injury in one eye, and 142 other workmen were saved from serious injury or total blindness in both eyes. It was assumed that an object which hit a goggle lens with such force as to pierce or shatter it would certainly have so damaged the eye, if the goggles had not been worn, as to cause complete loss of vision.

During our study of "Eyes Saved in Industry," an official of the Bessemer Limestone & Cement Co. wrote to us: "I have one case in mind, occurring about six months ago, in which a man was injured by the explosion of hot Babbitt metal. His face was badly burned, but his eyes were protected with goggles, the lenses of which were covered with the metal. Since that time we have supplied and insist upon the use of helmets for this work."

From another cement company this letter was received: "We have a specific case in which we can honestly say that a man's eye was saved through the use of goggles. This occurred at Plant No. 4, when a quarry repairman was engaged in cutting off a rivet from a quarry car. The rivet struck the man's goggles on the corner of one of the lenses near the frame. The glass was broken but not so that it was dangerous; the goggles saved the man's eye, without a doubt, and probably his life. If he had not worn the goggles this rivet might have struck him on the temple. While we compel employees to wear goggles at all times, we are trying to stop all flying objects, molten metals, and foreign bodies at their source. We find that a great majority of eye accidents can be confined to the source by proper methods, an example being that of our bag department. Heretofore we compelled the use of goggles for fear of splashing cement from bags. The goggles prevented the cement from entering the eye, but struck the employees in the face. We have now exercised care in sorting our bags and find that there is no more trouble from cement flying from bags."

Any reader of PIT AND QUARRY whose interest is aroused by this article may secure more information and other help by writing to me at the National Society for the Prevention of Blindness, 450 Seventh Avenue, New York.

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The Iola, Kan., plant of the Lehigh Portland Cement Co. has just completed a six-year no-accident record, in which no employee has sustained a fatal, partial disability or even a lost-time injury. No cement plant on the American continent has ever succeeded in reaching this record. It covers operations at the quarry as well as in the mill.

C. A. Swiggett, superintendent and chairman of the safety committee, has been swamped with congratulatory telegrams and messages from leaders of the cement industry throughout the country. The record was established September 9.

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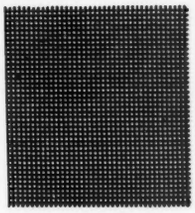

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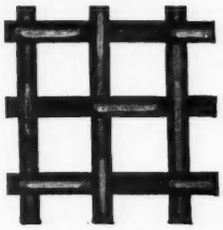

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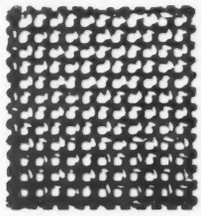

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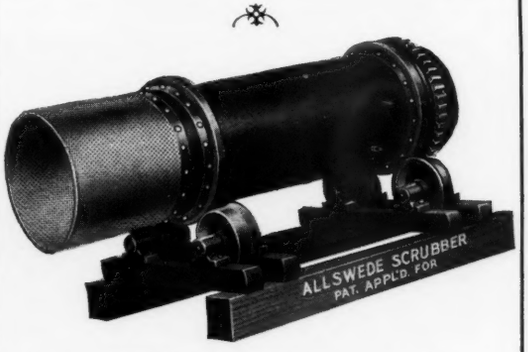

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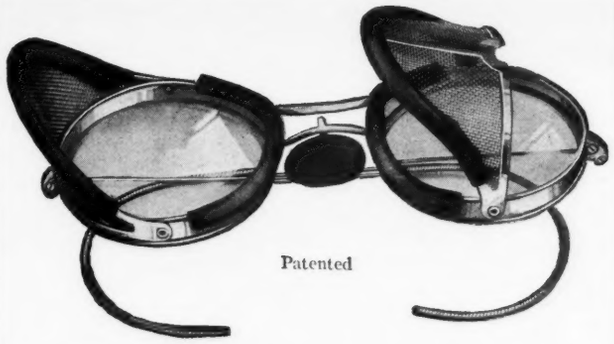

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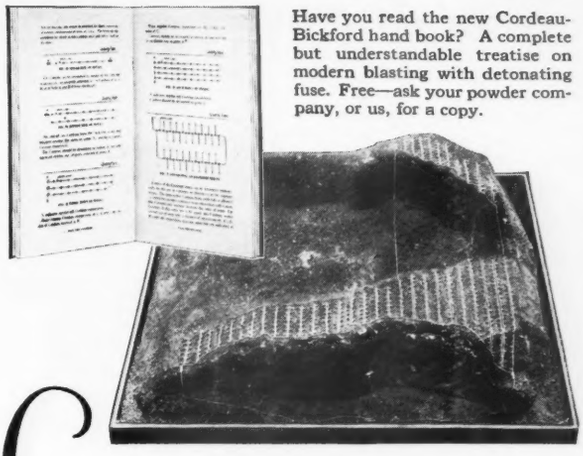

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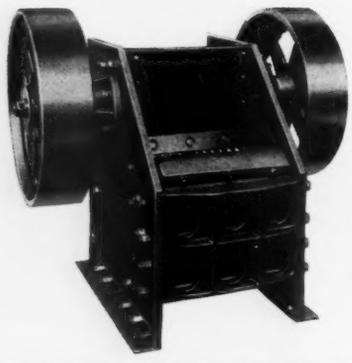

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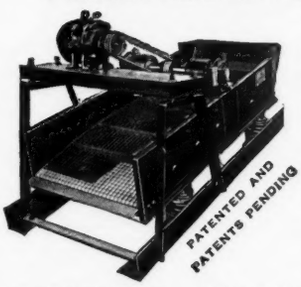

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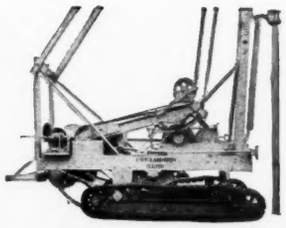

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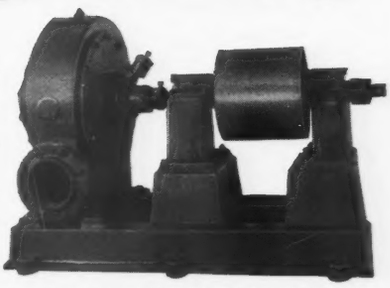

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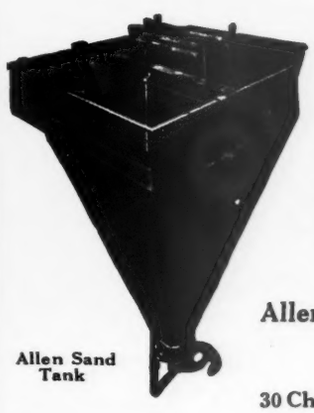

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1-200	Wsthse.	440	Slip Ring	500
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10. Superintendent; 10 years' experience; lime and stone.

11. Superintendent crushed stone; 25 years' experience.

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15. Experienced superintendent or manager; graduate engineer; 12 years' experience in sand and gravel production and plant design.

16. Superintendent, 30 yrs. experience, mine, mill and quarry and large shovel operations, thorough knowledge of various systems of underground and open pit mining. Development work from grass roots to mill construction and operation, copper, iron, zinc and non-metallics, 4 yrs. special work in asbestos, mica and kaolin, good organizer and good production and safety record but not a college graduate. South, Southwest or Tropics preferred.

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25. Dragline, Crane and Shovel Operator, 9 years' experience in steam and 3 years on electric shovel (Marion), desires position as operator. Can do own repairing. Permanent connection desired. Married. References furnished. Will go anywhere, but a location near good schools preferred.

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27. Laboratory work, 3 years' experience as Asst. Chemist doing control and analytical work. College graduate, B. S. degree.

28. 12 years' experience as cement burner and night foreman and watchman.

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30. Crushing plant and quarry Superintendent. Experience includes erecting, rebuilding and repairing machinery. Successful in organizing labor for economy. References furnished.

31. Superintendent crushing plant. 10 yrs. limestone and rock asphalt quarry operation experience. Can furnish best of references. Will go anywhere.

32. An overhead traveling bridge crane man. Experienced. Can give good references. Willing to go anywhere.

33. Cement mill general foreman, 12 years' experience, familiar with all requirements in construction and operation. Available immediately. Can locate anywhere. Single.

34. Capable man. 53 years old. Married, experienced in quarry and crushing plant, timekeeping, payroll and plant office work, seeks position as assistant superintendent, general foreman or plant office work, where experience and loyalty will be appreciated. Will not be interested in investing money at the present time in any position. Have you an opening?

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39. Ten years experience as Burner man; reliable. Age 37. Desires position where ability and skill will be appreciated by advancement. Available immediately.

40. Man with 10 years practical experience in civil engineering and highway construction of all kinds as well as bridges, grading, culverts, etc. Understands map making and topographica' survey. Included with this is 4 years tracing and drawing. 3 years with army engineers in Panama. Salary no object.

42. General superintendent or manager; experienced graduate engineer.

43. Sales Engineer desires making change, preferably New England territory. 20 yrs. experience with a reputable concern designing, estimating and selling material handling equipment in all phases. Broad acquaintance among executives and buyers.

44. Want position as carpenter or millwright, capable of taking charge of gang. Steady work preferred with cement company.

45. Operator with ten years' experience on Bucyrus-Erie Steam and P. and H. Gas Shovels in grading, gravel pit and stone quarry work. Can furnish references.

46. Gravel plant supt. or manager. 10 yrs. supt. of large railroad and trucking plants. Experienced in erection and care of gravel plant equipment. Can furnish best of references. Services available at once. Will go anywhere.

47. Graduate Engineer. 25 yrs'. experience as designing, constructing and operating Engineer, as well as Supt. of stone crushing and gravel washing plants, also heavy rock blasting.

48. Graduate Engineer. Wide experience as mining, consulting and sales Engineer, in charge of all outside operations, construction and maintenance. A-1 references.

49. 15 yrs'. experience in erecting and operation, crushing, grinding, washing, drying, screening and separation plants. Know value of low production costs. Good references.

50. Gravel Plant Supt. 7 yrs'. experience erecting and operating gravel plant equipment for large manufacturer. 2 yrs. in charge of mining operations in Brazil. Best of references.

51. Supt. of crushed stone and gravel plants. 12 yrs. experience. Familiar with maintenance and repair work on all types of equipment. Can handle men. First class references.

52. Past experience with Crushed Stone and Sand and Gravel plants; in sales, can figure with contractors, scales, cost, timekeeping, bookkeeping, general all-around man.

53. Quarry superintendent with years of experience in all operations, such as stripping, drilling, blasting, shovel loading, crushing, sinking, also repairing of all quarry equipment and familiar with all phases of washing crushed stone. Now open for proposition. Excellent reference.

54. Engineer experienced in Mechanical, Structural, Electrical, Plant Design and Layout, Estimating, Field work, Maintenance and Millwork desires position. Will locate anywhere.

55. Superintendent of crushed stone products plant and quarry. Twenty years' experience in this and foreign countries in charge of operations. Familiar with modern up-to-date methods and profitable application of same.

56. Master Mechanic, thoroughly trained in the upkeep of crushers, steam shovels, gas and diesel equipment, etc. Reference and complete information on request.

Can You Use THESE MEN ?

Employment Dept.
PIT AND QUARRY
538 So. Clark St. Chicago, Ill.

57. General operating Superintendent desires position with progressive Lime or Cement Company. 20 years' experience as operating superintendent and master mechanic. Familiar with Limestone quarries and burning of limestone and Portland Cement with natural gas or Producer gas. Master Mechanic of large Lime and Cement plants. Installed reasonable system which did not bar progress of operation. References A-1.

58. Position as Superintendent by graduate Mining Engineer. 35 years old with wide operating experience in large open pit mines and crushed stone plants up to 10,000 tons. Thoroughly experienced in Quarry layout, development, heavy blasting, shovel loading, transportation and mill design and operation, electric or steam power, and with latest type high speed reduction crushers, screen analysis of a sampling and grading of specification stone.

59. 13 years' experience in general office work, including correspondence, sales and operations. Well acquainted with freight rate structures on crushed stone, sand and gravel and cement. Desire connection with any concern where ability and experience would be appreciated.

60. Slackline Cableway operator. 5 years' experience. Can keep cableway operating at full capacity. Can do repair work. Had experience raising and lowering mast or tower. Can do all necessary rigging around cableway.

61. Wants position as foreman of a rock, sand and gravel, or oil-mix plant, preferably the latter. Several years' experience as foreman of oil-mix and hot stuff proportioning plant. Can furnish best of references from previous employers and contracting engineers. Will go anywhere but prefer the west or middle west.

62. Position wanted as quarry superintendent. Prefer southwest or west coast.

63. Stone Quarry Supt. or Supt. asst. 14 yrs. experience in commercial stone and railroad ballasting; operating and repairing all kinds and makes of equipment. Wide experience in drilling and blasting. A-1 references.

64. Position wanted by operator with 15 years' experience on cranes, shovels, draglines, sand pumps, dredges, etc. 35 years of age, can furnish A-1 references. Will go anywhere.

65. Graduate mechanical and structural engineer with wide experience on cement and stone plants. Permanent or temporary employment.

66. Superintendent or Foreman of Quarry and Crushing plant or Sand and Gravel plant. 30 years' experience. Can make good anywhere. A-1 references. Available now and will locate anywhere at moderate salary.

67. Successful manager of stone crushing plants, also sand and gravel pits, desires position where previous experience will prove of mutual benefit. Can also sell sand, gravel and stone products or machinery and electrical equipment.

68. Superintendent and Foreman with wide experience in operation of slag, sand and gravel and stone plants. Also experience in railroad work, road construction, grading, ditching, bridges, concrete work, all kinds of excavation, government inspection. Can operate gas and electric cranes. Best of references.

69. Engineer and draftsman, fifteen years' experience, machinery design; structural; plant layout, development, thoroly acquainted with architectural and mechanical design. Technical graduate, also business management and administration course, Alexander Hamilton Institute. Field and office experience. Age 37 years. References.

70. Office man, 10 years' experience in general office work, payrolls, costs, and operations. 9 years with Gypsum Co. Age 30, married, and A-1 references. Will locate in Eastern and Middle States. Prefer lime, cement, and gypsum concerns. Available immediately.

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***See also information in the 1932 Pit and Quarry HANDBOOK**